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THE ATTITUDE OF THE FORESTRY PROFESSION TOWARD A NATIONAL FOREST POLICY¹

BY RALPH S. HOSMER

President, Society of American Foresters

MR. CHAIRMAN AND GENTLEMEN OF THE COMMITTEE:

I appear as the representative of the Society of American Foresters, the national organization of the profession of forestry in the United States. The Society is strictly a professional body. Its membership is limited to technically trained foresters, approximately 1,000 in number, actively engaged in the practice of forestry. The headquarters are at Washington, D. C., with sections in various parts of the country. Its members are in the service of the Federal and State Governments, in the employ of the forest industries and other corporations, in private forest work, and on the faculties of the forest schools. The Society publishes the only technical forestry periodical in the United States, the JOURNAL OF FORESTRY, of which there are eight issues a year. The purpose of the present statement is to put before the Senate Committee on Reforestation the point of view of the professional foresters of the United States in regard to an expansion of our national forest policy.

The imperative need of making adequate provision for an assured timber supply for the nation requires no argument before this committee. The facts and figures presented by the Forest Service in the "Timber Depletion Report" of June 1, 1920, and in the article "Timber: Mine or Crop?" in the recently issued Yearbook of the U. S. Department of Agriculture for 1922, make it needless to cite statistics. The

¹ A statement made to the U. S. Senate Committee on Reforestation, Albany, New York, Sept. 21, 1923.

present situation speaks for itself. The problem is how shall we as a nation proceed in restoring to productivity the great areas of forest land that require to be restocked? There is need for the formulation of a comprehensive program. To be lasting and effective that program must be sane, reasonable, just to all concerned, and possible of practical execution. In the minds of the foresters there is no question but that such a program can be evolved and put into operation. The problem is essentially one of ways and means.

From the data that are now before us it is the opinion of a majority of the professional foresters that only from forests within the confines of our own country can we seek for the solution of the problem of creating a permanent timber supply for the United States. What little hope there may have been in looking to the importation of timber from other countries is shattered by the conclusions reached by Zon and Sparhawk of the Forest Service in their recently published book, "The Forest Resources of the World." That comprehensive and authoritative presentation makes it absolutely clear that our vast needs for wood in its various forms can only be met from forests near at hand. When the softwoods in what remains of our original forests are exhausted, there is no other place to which we can turn, except at prohibitive cost, for more coniferous timber. The prices that would result from competition in the world markets and from transportation makes any other course impractical, if the United States is to continue to be a wood-using nation in the sense that it is today. And who of us wishes to lower the high standard of living that has come about in so large part because we had an ample supply of timber and of wood?

Even as regards pulpwood from Canada the situation is but little better. As regards forest resources the United States and Canada are essentially in the same boat. The forests of the Dominion of Canada are no more inexhaustible than were our own. Canadian timber will undoubtedly help us to tide over in part the period of greatest stress but, at best, this aid can be but temporary. Furthermore, the British Empire is even now making plans for the utilization of the major part of the resources of the Empire within its own boundaries. But even if this were not so, to attempt, by whatever means, to force a repetition in the Dominion of the ill-considered methods of exploitation of the forest of which we have seen all too much in this country would be but to rock the boat. The conservation through wise use of the forests of the North American continent must be regarded as a matter of

international concern. In the opinion of foresters the forests of North America form a single unit, and must be treated as such.

"Forestry is the perpetuation of the forest through wise use." The forester's ideal is continuous production through sustained yield—the removal, in approximately equal amounts, at any given cut of not more than nature has replaced through growth since the last previous cut—and along with this, in American forests, a steady increase in both the quantity and quality of the forest crop harvested. It will necessarily be a long time before this ideal can be realized in the United States, but it is imperative that a start be made at once toward that goal. In the testimony which Col. W. B. Greeley gave before this committee at Washington last April, he made perfectly clear how a permanent timber supply for the United States can be secured through intensive forestry. The need today is to follow up the start already made in the establishment of our National Forests.

So far our national forest policy has dealt primarily with the creation, organization and administration of public forests, especially National Forests. The next step is to bring under forest management all the forest lands of the country, irrespective of ownership. This move can best be made by placing emphasis on a few things, as to the necessity for which all those who have given this subject serious consideration are in practical accord. The list is short. It consists of five principal points: prevention of forest fire; just forest taxation; additions to the existing areas of publicly owned forest; better provision for the assistance of the private forest land owner, both in aid in reforestation and in the proper management of existing woodland; and increased support of forest investigation and research. These, in the judgment of the Society of American Foresters, are the essential things to be striven for at the present time. They by no means constitute the whole of forestry—a fact that should not be lost sight of—but they are today the things of first importance, and must in any event precede other and more intensive measures.

The five points enumerated are embodied in the Clarke bill now before Congress. It is the strong feeling of the Society of American Foresters that were this committee to recommend and secure the enactment of legislation generally similar in character to the provisions of that bill, a very long step would have been taken toward the ultimate solution of the national timber supply problem.

There are, of course, many other points that must ultimately be considered. But important as are the knotty questions of what constitutes the right use of privately owned forest land, and as to how far the ownership of forest lands carries with it an implied obligation to maintain that land in a state of productivity, the settlement of these questions can well be postponed to a later time. It may, however, be noted in passing that there is now in this country a rapidly growing public sentiment which is little inclined to tolerate methods of forest exploitation that lead to devastation, whatever may have been the public attitude in such matters in the past. But once we have adequate protection of the forests of the United States from fire and just forest taxation, these other problems cannot but be simplified. The changing economic conditions brought about by the rapid diminution of our remaining areas of original forest, plus the fact that all of the first growth forest that is left will soon be on the Pacific Coast, and hence remote from the chief centers of consumption, will all tend to hasten the time when the raising of commercial forests, especially in the Eastern States, may appear more attractive as a strictly business proposition than it does to some at this moment. The duty of today is plainly to tackle first the most obvious needs.

PREVENTION OF FOREST FIRE

Forest fire is admittedly the most serious enemy of the forest, notwithstanding the startling figures of damage and loss that result from insect depredations and from diseases caused by fungi. In the last 15 years remarkable progress has been made toward adequate protection of the forest from fire on the National Forests and in certain of the States. It has there been demonstrated that fire in the forest can be held down to a very low percentage of loss. If this is true of certain forests, it can be made true of all forests. The practical thing to do is to extend efficient methods of forest fire control. This, of course, takes money, but when the returns are considered, direct and indirect, it is evident that it is a good investment. The remedy for the present forest fire situation is to provide for funds sufficient to give to all our forest areas really efficient protection. Col. Greeley has indicated that on the average an outlay of three cents per acre per annum, would accomplish this. A large part of the money required would, of course, be furnished by the individual States. The first step toward

this end is a substantial increase in the appropriations made by the Federal Government under Part II of the Weeks' law, under the co-operative program with the several States, that has proven so successful since 1911. Fire prevention is by no means the whole of forest management, but everywhere it is the essential first step.

JUST FOREST TAXATION

The just taxation of forest products is almost as essential to the continuous production of forests by the private owner of forest land as is the prevention of forest fire. Together these two things constitute the corner stone of successful forestry practice. Forests should be taxed. In the opinion of foresters there is no good reason why this form of wealth should not return its share to the State, but the taxing of forests should be just. Under the method of the general property tax, now in use in most of the States, the raising of second growth forests is put under a distinct handicap, often to such an extent as to amount to an inhibition. Foresters advocate instead a tax based on the principle of a levy on the yield, preferably imposed once, at the time of the harvest of the forest crop; in other words the so-called "yield tax."

The introduction of a new system of forest taxation is frankly a difficult problem; one that requires no little study before the method best adapted to any particular locality can be arrived at. In some of the States a change in the State constitution is a necessary prerequisite. Everywhere the needs of the local communities for a regular revenue must be taken into account. It is not easy to frame workable forest tax laws. That now in force in Massachusetts is the nearest approach to what may be considered as satisfactory. The situation calls for a careful and comprehensive study of the whole problem of forest taxation in its national aspects, notwithstanding the fact that the taxing of forests is and must be a State function. A study of this kind can best be made under Federal auspices. The Society of American Foresters urges the Senate Committee on Reforestation to recommend in its report that adequate provision be made for such an investigation.

It may further be said here that the Society of American Foresters is not in favor of the suggestion that the prior enactment of revised forest tax laws be made one of the provisions upon which is conditioned the allotment of financial assistance by the Federal Government to the States, under cooperative agreements. Every encouragement

should be given the several States to enact just forest tax laws. But as it must necessarily be some years before legislation of this type can be enacted in all the States, the Federal Government should not in the meantime prevent the States from benefitting from Federal aid in the development and prosecution of other forms of forest work.

INCREASED AREA OF FORESTS UNDER PUBLIC OWNERSHIP

There should be a very considerable increase in the area of forest in public ownership under the Federal government, the individual States, and local communities. The extension of State forests should be encouraged by all legitimate means and in general the American people should be made to understand the distinct economic advantages that are to be secured from the local public ownership of forests by cities, towns, and villages. The experience of the European countries in this connection is conclusive evidence of the advantages that come from this type of forest, different as are the local conditions that obtain there and here.

As to National Forests, there are still considerable areas of the Public Domain that are better adapted for the production of forest than for any other use. These should be included in National Forests, as should also certain other scattered areas of government-owned land, no longer needed for other public use, like some of the old military reservations. The acquisition by the National Forest Reservation Commission of the lands needed to round out and complete the "purchase areas" already approved should be continued. Some of these areas should be enlarged and others added, further to protect important streams. This is work that for the present ought steadily to go on. The Society of American Foresters favors an annual grant by Congress for this purpose and suggests as an appropriate amount the sum of \$2,000,000.

But there is another type of national forest that in the judgment of foresters ought also to be provided for by proper Federal authorization. In parts of the Lake States are great areas of land that can only be made of value through reforestation. The same is true to an even greater extent in parts of the South. These lands have in the past produced some of the finest timber that has been cut in the United States. They could grow like forests in the future. On these lands productive agriculture is impossible. Forest products are the

only profitable crops which they can be made to yield. Were parts of these areas to be acquired and set apart as National Forests, not only would they be turned to good account, but such action would unquestionably go a long way toward stimulating the reestablishment of forests on other lands of similar character in the same localities by the States and by private owners.

It may be that there are constitutional difficulties in the creation of National Forests where the object is primarily the growing of commercially valuable timber, rather than the influence of the forest cover on the navigability of navigable streams. That is a legal phase of the question that need not be enlarged upon here. But could it be so provided by appropriate Federal and State legislation, it is the judgment of the Society of American Foresters that the powers of the National Forest Reservation Commission ought to be extended so as to include acquisition of land of this type.

Most foresters recognize that while public ownership of large areas is desirable, a large part of the forest land of the United States must and probably always should be privately owned. The question of public ownership, where the purchase of forest land is involved, is necessarily bound up with that of how the money is to be provided to meet the initial cost. It is obviously out of reason to expect that all forest land can be purchased by the public, whether as Federal State, or community forests. Nor is it desirable that this should be done. The Society of American Foresters is opposed to the proposals that have been made by certain of those who have appeared before this Committee that the public should be expected necessarily to buy out the owners of devastated forest lands. Rather do the foresters suggest that the Federal and State Governments acquire what may be termed the key areas in regions like those above enumerated, and there demonstrate to the owners of the adjoining areas what may be accomplished through systematic forestry measures in the reestablishment and profitable management of forests. Were provision made in certain States that the land useful only for forest production that reverted to the State for nonpayment of taxes become state forest, a further step would be accomplished.

The time has already arrived in certain parts of the country, as for example in the white-pine region of southern New Hampshire and in parts of the South, where the growing of a forest crop is a profitable venture. In many sections of our country we are for-

tunate in that, provided fire is kept out, the forest will replace itself naturally. But even where the planting of a new forest is required, the time is rapidly approaching when it will pay to grow forests. To engage in the business of raising forests may, it is true, require the organization of a corporation on a different basis from that now in use by the average lumber company. There the tenure of life of the company is usually predicated on the utilization of a given stand of already mature timber. There would be required a form of incorporation that would look to returns from the harvest of successive crops of timber, indefinitely. When economic conditions appear to show a fair probability for profit in forest growing, we shall see such corporations set up. That time will soon be at hand. It is not necessary, therefore, to depend for our future timber supplies exclusively on publicly owned forests.

It is also to be noted in this connection that more and more is it coming to be realized, although perhaps as yet more in the Eastern States than in the West, that land covered with thrifty second growth forest, although too small to cut, is an asset rather than a liability. When this point of view comes more generally to be accepted, it will be but a short step to the introduction of real forest management.

ASSISTANCE TO FOREST-LAND OWNERS

As regards the encouragement of forestry on privately owned forest lands there is, in the judgment of the Society of American Foresters, particular need at this time for an increase in the assistance which may be rendered through the cooperation of the Federal with the State Governments. In the aggregate a very large area of forest land is included in the farm woodlots and other woodlands of this country, especially in the East. Were all this land producing forest crops at its maximum capacity there would be a by no means inconsiderable addition to the nation's wood pile. It is therefore highly desirable that reasonable aid and assistance be furnished the owners of such lands in the practice of forestry.

Already in many of the States forest nursery stock may be readily obtained from State nurseries, while technical advice can be had from the forestry extension services of the State forester, or of the State Agricultural College, as to the best methods of handling young or mature stands of existing forest. This work needs, however, to be greatly expanded. The average farm woodlot is far from producing

what it easily might were a few of the simpler principles of forest management better understood and practiced.

Taking the case of New York State as an example, the widespread popular interest in forest planting that marked the spring months of 1923 shows that a real demand exists for such help and that there would be a prompt response to offers of even a little additional aid. A slight favorable difference in the initial cost of a forestry project is often quite enough to lead to its adoption. The Society of American Foresters favors the general plan of cooperation in forestry extension work that is contained in the Clarke bill (H. R. 14241). It suggests that the Senate Committee on Reforestation incorporate similar proposals in its recommendations.

RESEARCH IN FORESTRY

As to the need of research in forestry perhaps no class of men is better qualified to judge than are the professional foresters. The practice of forestry is a relatively new departure in the United States. It is only a little over a generation ago that even the word forestry was all but unknown. There is very much that remains to be found out about our forests before they can be made to produce the maximum quantity and quality of wood in the shortest practicable time. The intensive forestry of Central Europe has to deal with only about a dozen trees. In the United States we have around 200 species that are used commercially, out of over twice that number of different native trees. About one hundred species may be classed as of the first rank in economic importance.

To acquire even a general knowledge of the conditions under which the valuable trees will grow best requires time; to get accurate figures as to their rates of growth, still more. At present many of our growth figures are necessarily based on measurements made in the original forest. Properly managed second growth forests should, with many species, show a faster rate and a greater yield per acre. That has been the experience abroad. One of the chief functions of forestry investigations is to obtain just this sort of information, preferably by exact measurements, repeated at definite intervals, in permanent sample plots.

There are many other problems in regard to the forest that also need to be investigated, such as studies of the life history of the

several species and the various interrelations that exist in the forest, to say nothing of the economic studies that have for their object the saving of waste and the complete and wise utilization of all the kinds of wood.

Work of this sort can best be carried on by permanent organizations like the universities and the Forest Experiment Stations of the Forest Service. The Forest Service now has ten such stations, the last two being those just opened in the Northeast and in the Lake States. One or two additional stations are needed, but more particularly should there be better financial support for those already established. The important work these stations are ready to do is often curtailed by lack of funds. Adequate provision for support of scientific work in forestry is one of the most important phases of the forest problem in the United States.

We have profited much from European experience, for the principles underlying the growth and development of forests are the same the world over, but we must in America work out our own methods of silviculture and of forest management. Only by such studies as are carried on by forest experiment stations can there be assembled the data on which an American system of silviculture must be based. The Society of American Foresters desires to urge most emphatically that the Senate committee take account of this need and that it emphasize its recommendations that especial provision be made for research work in forestry.

The foregoing statement has emphasized the five points that seem to the foresters of this country to be the most important of the steps that should be taken at this time in the expansion of the national forestry program. Several of them must necessarily precede the development of more intensive forestry measures. All are noncontroversial, and of a character that well justifies the expenditure of the money necessary to put them into operation. It is the hope, as it is the recommendation, of the Society of American Foresters that when the Senate Committee on Reforestation comes to make its report, it will take a strong position in advocating these measures.

THE FEDERAL INCOME TAX AND FORESTRY

By R. C. HALL

In order to consider how the Federal income tax affects, or may affect, the practice of forestry in the United States, it is necessary to know in a general way how the taxable income of forest owners is determined under the Federal revenue acts. Therefore, we will review the history of income tax legislation in so far as necessary to understand certain aspects of income tax determination, which are of especial importance to the forest industries.

The sixteenth amendment to the Constitution authorizing Congress to levy a tax on income was adopted March 1, 1913, and, pursuant to this authority an income tax of 1 per cent, with small surtaxes applicable to individuals with net incomes of over \$20,000, was enacted. The normal rate remained unchanged until 1916 when it was raised to 2 per cent. These low rates, combined with liberal exemptions, made the income tax negligible as an economic factor prior to 1917.

The participation of the United States in the world war beginning in 1917 called for huge sums of money. Following the example of the European governments, the United States decided to raise these sums largely through the income tax. In 1917 the normal rate was raised to 4 per cent. Heavy surtaxes were added in the case of individuals and an excess profits tax in the case of corporations. In 1918 the normal tax, surtaxes, and excess profits taxes were still further increased, so that many corporations and individuals were forced to contribute 30 to 60 per cent of their net income in taxes. In 1913 the total income tax collected was about \$70,000,000. In 1918 it amounted to more than \$4,000,000,000. Since 1918 the rates have been moderated and in 1922 and subsequent years there is for individuals a normal tax of 4 per cent with surtaxes so graduated that the maximum rate an individual can pay is 58 per cent, while for corporations there is a rate of 12½ per cent, with no excess profits tax. On account of the great increase in the Federal budget owing chiefly to interest and sinking fund requirements of the war debt, there is little possibility of further material reductions in these rates for the immediate future. As far as can be foreseen at present, a fairly heavy income tax appears to be a permanent economic factor.

What features of the income tax are of peculiar importance to the forest industries? The most important is the allowance for depletion of timber. The amount of tax for which any individual or corporation is liable in a given year depends on the amount of net income, which is determined by subtracting from the gross income for that year certain deductions which are defined in the Revenue Acts. These deductions include a reasonable allowance for depletion of capital assets, such as minerals, oil and gas, and timber. By depletion is meant the process of using up capital assets in the production of goods. In the process of mining, the capital asset consisting of ore in the ground is depleted; in the process of producing lumber, the owner of timberlands depletes a capital asset consisting of timber on the stump. In the case of the lumber industry the depletion allowance for a given year consists of the stumpage value of the timber used during that year. In other words, to determine the net taxable income of a lumber manufacturer owning its own timber supply, there is deducted not only ordinary and necessary expenses of the business and depreciation on the plant but also the stumpage cost or value of the timber used during the year. That portion of the annual receipts representing this stumpage value is a return of capital and as such can not properly be included in net income.

The basis for the determination of the stumpage values which may be deducted as depletion is highly important. The earlier income tax laws did not specify how these values were to be determined. In the absence of such specific provision, the Bureau of Internal Revenue prescribed original cost of the timber as the basis. This viewpoint was contested by taxpayers who had bought their timber in earlier years at low prices, and suits were brought. As late as May, 1918, the governing principle was laid down by the Supreme Court in the Doyle-Mitchell case. Since then it has been recognized that the value as of March 1, 1913, must be used rather than the original cost in the case of timber acquired by the taxpayer prior to that date. The theory is that the amendment to the Constitution providing for an income tax was effective on March 1, 1913, and gave authority to tax income accruing after that date. To tax appreciation in value up to that date would be to tax property, not income. Therefore, not only the original cost but the appreciation in value of stumpage up to March 1, 1913, should be included in the allowance for return of capital through depletion. This principle has been recognized in subsequent

acts and depletion is accordingly allowed on the basis of March 1, 1913, value, if acquired prior to that date, and on cost if purchased subsequent to February 28, 1913. A similar basis is used for determining the taxable profit from sale of timber or timberlands.

The principle established in the Doyle-Mitchell decision is of utmost importance to the lumber industry as the ultimate saving in taxes to the industry as the result of using March 1, 1913, values instead of cost as basis for depletion is roughly estimated at \$200,000,000. By this decision, taxpayers who had originally bought timber at low prices and held it for a considerable period prior to March 1, 1913, were placed on an equitable footing as far as the determination of depletion allowances is concerned with those who have purchased timber at higher prices in and around 1913. This decision also faced the Bureau of Internal Revenue with the enormous task of passing on the values as of March 1, 1913, of all the large bodies of timberland in the United States and of considerable timber properties owned by citizens of the United States in Canada, Mexico, and other foreign countries. It soon became apparent that the Bureau would require a technical force in order to attack this problem. Accordingly, a Timber Valuation Section was organized coordinate with valuation sections previously formed within the Bureau for valuing oil and gas, mineral and coal properties. The advice and cooperation of the lumber industry was obtained in connection with the formation of the Timber Section, and on the recommendation of leading representatives of the industry, a forester was chosen to organize and direct the work. Nearly all of the valuation engineers appointed since that time have been foresters. The work of the Timber Section is not confined to the valuation of timber, but involves an examination of the returns of the taxpayers who use standing timber, with respect to such factors as unit cost of timber acquired since February 28, 1913, depreciation of sawmills, logging equipment and other physical property, and valuation of lumber and log inventories.

The fact that the Timber Section is composed largely of foresters results in an indirect relationship between the income tax and the practice of forestry. The work is of such a nature as to bring the members of the Section in close contact with the lumbermen of the United States, especially with the leading men of the industry. The requirements of the law have done much to abolish the old slipshod accounting methods that were so common in the past, with the result

that many lumbermen have been forced to learn much about their own business that they never knew before, but that they find useful and profitable to know. The valuation problems involved have required a most careful analysis of the basis for and trend of stumpage values. The differences of opinion in determining these values, inevitable on account of the conflicting interests, have resulted in a great deal of discussion and investigation. This has led to a better understanding on both sides. It has given members of the Section an opportunity to point out possibilities in the management of forest lands. The training which the work in the Section has given them on the economic side of the lumber industry has been of value in enabling them to make practical suggestions. Two former members of the Timber Section are now engaged in the field of forest engineering in the West, and their work with lumber companies has undoubtedly been greatly facilitated through contacts made while in tax work. Another member is soon leaving to make forest management plans for important interests in the South and West. It is quite possible that others may follow these examples, and that by their work the practice of forestry by private owners may be stimulated.

The direct effects of the income tax on the practice of forestry are not many. It does not affect the intensity of utilization for the reason that it takes for the Government only a part of profits, and the lowest grade timber which may be profitably removed without such a tax may still be removed with the tax, and leave some profit to the operator. Unlike a property tax, it has for obvious reasons no tendency to force timber owners to cut in advance of market requirements; under some circumstances the tendency is in the other direction. The income tax as it stands today has little if any effect in the restriction of speculation and trading in timberlands, as the tax on profit from sales is limited to 12½ per cent, if the property has been held for more than two years. Of course while the excess profits tax and high surtax schedules were in effect during the years 1918 to 1921 they acted in many cases as a powerful deterrent to the transfer of timberlands. The owner might easily have been in such a position that to sell his property at an apparent profit of 100 per cent might have been to suffer an actual loss after paying the tax, giving consideration to the purchasing power of money at the time of the sale relative to the time that he made the investment.

The most important question in connection with administration of the income tax from the standpoint of forestry is the treatment of

growth in timber. The Revenue Acts make no specific provision for growth. They contemplate treating timberlands exactly as mines, as if a tract of timber were equivalent to a body of ore in the ground which when worked out is not by any natural process renewed. In doing so they have but reflected the heretofore prevailing American attitude.

The reason that growth of timber affects the determination of tax liability is that if growth is taken into consideration the timber account and consequently the allowances for depletion are affected, while if growth is neglected, in the course of time the quantity of timber remaining on the ground is not adequately represented by the book figure for standing timber in the timber account and eventually there is no legal basis for any depletion allowance. Taking for simplicity the case of an operation based on a single purchase since March 1, 1913, or a single timber property owned on March 1, 1913, the timber account starts with the estimated quantity of standing timber and the capital investment in timber which is returnable untaxed through depletion, either the value at March 1, 1913, or the cost if acquired at a later date. As the operation proceeds the quantity of timber is reduced each year by the quantity cut, and the capital reduced correspondingly by a proportionate part of the investment. This reduction of capital is the amount of the depletion allowance which is deductible in computing net income subject to tax. In the case of a virgin or nearly virgin tract, growth is offset by decay, so that barring changes in utilization or correction in estimate, no adjustments are necessary to keep the books in agreement with the actual quantity of timber present. At the conclusion of the operation all of the quantity is depleted out of the timber account and the total investment has been returned through depletion allowances at a uniform rate. Unless the operation is an abnormal one, such young forest as may have developed on the cutover land has not reached merchantable size, and is negligible from the standpoint of the operator who is closing out and disposing of the land as best he can. Thus in a relatively short operation in virgin or nearly virgin timber growth is in reality not a factor, and the theory of depletion as in the case of a mine may be applied without embarrassment.

However, in some parts of the country conditions are such that many timberland owners are getting away from the mining theory and take account of growth in their operations. Some large operators

are managing their timberlands with a view to continuous production. Others have considerable second growth stands from which they contemplate getting at least a second cut. In such cases there is being cut not only the timber which was present at the opening of the timber account, but also growth increment which has accrued since that time. The quantity on hand at the beginning is not as in the case of the short operation in virgin timber the quantity which will ultimately be removed. The question in income tax accounting is to decide what to do with this additional timber acquired by growth since March 1, 1913, or date of subsequent purchase, when the timberland account was set up. As has been pointed out, there is nothing in the Federal revenue acts which specifically provides for this situation.

There are three possible solutions to this problem:

(1) All of the timber cut may be treated as from the timber owned at the beginning, and depletion allowed at the original rate until the total capital returnable through depletion is exhausted, after which no further deductions are allowable as depletion.

(2) The annual increment by growth may be treated as an offset to depletion; that is, the quantity of timber cut in a given year less the estimated annual increment by growth may be considered as the actual depletion in that year, and this quantity multiplied by the unit depletion rate obtained by dividing the original investment by the original quantity of timber would give the allowable depletion deduction for that year. In the case of a property managed on a sustained yield basis, no depletion deduction would be allowed as growth would approximately equal the cut.

(3) The annual increment by growth may be added to the quantity of timber on hand and the unit depletion rate adjusted each year by dividing the remaining capital investment by the remaining quantity of timber thus increased. For convenience, this adjustment would probably be made not every year, but from time to time at five to ten year intervals. This method would have the effect of progressively reducing the unit rate used for computing the depletion allowance which would start at the same figure as under the first plan, but which would be decreased at each adjustment for growth and eventually become negligible.

The first plan of entirely disregarding the element of growth is open to objection on the ground that after a few years from the beginning the timber account no longer reflects the actual quantity of timber on

the ground. It is not compatible with regulation for sustained yield, since in a forest with a normal growing stock, the capital investment is permanent and is not wiped out when a quantity of timber equal to that which was present when the account was opened has been cut. The result of applying this plant to a managed forest is that eventually the capital account will be entirely exhausted on the books and no further allowance for depletion is deductible from gross receipts in the computation of net or taxable income. It is, however, a satisfactory makeshift and in relatively short operations, such as comprise the great majority of lumber manufacturing enterprises, it works out in practical effect like the third method.

The second plan, that of offsetting growth against depletion, is in agreement with the theory of forest regulation. If the growing stock is being reduced by a cut in excess of increment by growth, this process is reflected in the timber account by a corresponding reduction in the capital investment. If the cut is not in excess of growth increment, the capital investment on the books, as on the ground, remains intact. However, it is objectionable in that from the standpoint of current tax liability it penalizes the practice of forestry in a degree proportionate to the extent that sustained yield is approached. The taxpayer who is practicing destructive lumbering obtains the benefit of a substantial deduction for depletion in determining his net income subject to tax. His neighbor and competitor in the lumber business, who is cutting only the annual growth gets no deduction of this kind. The best the latter can do is to partially offset the difference by charging to current expense certain costs of growing timber, which are more properly capital expenditures, but which are allowable as expense under the law. The viewpoint that depletion should be considered as not taking place when the cut does not exceed the growth has been advanced by certain taxpayers with reference to the determination of invested capital under the excess profits tax law, with a view to avoiding the impairment of capital through depletion in years prior to 1917 when tax rates were low. On being shown the effect of the application of this theory to determination of current depletion allowances, all effort to force this viewpoint has been abandoned. It is, however, a theoretically sound method and may be applicable without disadvantageous effect at some time in the future when practically all forest lands are managed for growth.

The third method, that of adjusting from time to time the quantity remaining in the timber account and the unit depletion rate, and depleting the capital by the amount of the entire cut multiplied by the adjusted rate, is that contemplated by the present income tax regulations. As under the second plan, the books continue to reflect the actual quantity of timber on the ground. There is also the practical advantage that at any time when it becomes apparent that the quantity of timber on hand does not agree with the book figure, an adjustment can be made to correct this discrepancy by reestimate, without a quantitative determination of the causes for the change. For example, it would be difficult to determine that such a difference consisted of gain by growth in such an amount, gain by increased utilization in another amount, and reduction by loss from fire and storm damage in still another amount. It is not necessary to determine the current rate of growth as in the second method. The fact that the depletion rate gradually diminishes may be defended on the theory that in the first year after the timber account is set up, all of the timber cut is from wood that was on hand at the beginning, while in succeeding years, the farther from the beginning, the larger proportion of the timber cut is from wood which was actually grown since the beginning of the account. However, although the quantity of timber shown on the books remains in accord with the facts, the capital investment in the case of a property on which a normal growing stock is maintained does not represent the facts, but is gradually reduced to practically nothing. This is not entirely the fault of this method of accounting for depletion, as the amount of the investment would tend to be maintained if the owner were permitted to capitalize current expenditures which may fairly be considered as the cost of growing timber. If it were possible to add to the timber investment account the taxes on cutover lands being held for timber growth, the money borrowed to carry an investment in such lands, and the additional cost of logging, fire protection and administration involved in conservative forest management, the increase in capital account would correspond to the growth increments added to the residual quantity of timber. Thus there would be maintained on the books a capital account corresponding to the actual wood capital on the ground. The difficulty lies in the fact that the income tax laws and regulations require the operator to charge expenditures of the kind mentioned to current expense rather than to capital account, or under certain conditions give him the option

of capitalizing or charging them to expense. Even though it might be possible under the Revenue Acts to change the rulings in such a way as to give the taxpayer the option of capitalizing these charges under all conditions, there is little doubt but that it would be practically impossible to force him to do so. The taxpayer as a rule is glad to take advantage of all deductions from gross income permissible, in order to obtain lower taxation for the current year. With the possibility of reaping a higher taxation in the future he is not so greatly concerned, as there is always a possibility that the rates may be lowered, or other changes made, and "a bird in the hand is worth two in the bush." Of course, the owner practicing forestry does not suffer any discrimination under this plan, but the tendency is for him to reap a present advantage offset by the possibility of a future disadvantage, speaking from a tax standpoint. The total deductions allowed on account of depletion and expense of growing timber are the same in any case; it is only a question of difference in tax rates at different periods.

Outside of the possibilities in treatment of growth, the income tax may influence the practice of forestry by private owners in another way. The revenue act of 1921 contains a provision of much importance to individual investors in cutover and second growth land. This provision limits the rate of taxation to $1\frac{1}{2}$ per cent on income derived from gain on the sale of capital assets which have been held for more than two years. Only men of wealth are affected as the rate on income from ordinary sources is not more than $12\frac{1}{2}$ per cent unless the net income is over \$16,000 per year. In 1920 over 78,000 persons reported net incomes of over \$20,000, and these doubtless included most large individual investors. Such individuals are continually seeking relief from high surtaxes. Tax exempt securities have offered the best refuge, but of course the yield on investments in such securities is low. An investment in land which is restocking to forest, or which may be economically restocked, offers a very attractive opportunity to the man of large income. It enables him to put his money where no current income will be realized. Not only is the tax on the income which would have been received avoided, but the State and county taxes and other carrying charges increase the allowable deductions from other income, thereby still further reducing the amount of tax which he must pay in current years. It should be noted that such reductions in taxable income come out of the highest surtax

brackets, thereby giving the maximum benefit in relief from income tax. When the lands are eventually sold and the value which is accrued over a period of years is realized, the tax on the income derived is limited to 12½ per cent. Therefore, if lands can be purchased for growing timber on such a basis as to offer fair returns to the investors which are not realized until the trees become merchantable, an investment in such lands has special advantages to the man whose income is so large that relief from high surtaxes is desired. It may be objected that there is a possibility that this provision of the 1921 act may be changed. While this is true, the tendency is to keep provisions which are in the direction of liberality to the taxpayer, unless found to be distinctly inequitable. It may also be objected that by the time what is now cut-over proper can be sold as merchantable timber, tax rates on ordinary income may be again so low that they are no longer an important factor. That is very probable, and " 'tis a consummation devoutly to be wished." Nevertheless the investor will have accomplished his object of avoiding the high surtaxes now in effect and likely to be in effect for a considerable period of years. In that case the investor will not have to sell his timberlands to realize the return on his investment at a moderate rate of taxation, but will have the option of realizing it through manufacture and sale of the timber. Whatever other considerations may handicap investment in lands for the purpose of growing timber, it is encouraging to note that the tendency of Federal taxation is in the other direction.

PROBLEMS OF THE FOREST CHEMIST

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A number of years ago forestry took on a new aspect. Its scope broadened and its very definition changed. While silviculture still remains the fundamental applied science on which forestry rests--and while the forester is still intent on "raising repeated crops on non-agricultural soils" he has other interests as well. He is occupied with the problems of marketing and *utilizing* his timber crop, and in certain phases of this utilization he has called into silent partnership—a man who has played many honorable roles in present day industry—the chemist.

The forest chemist has invariably stood for the intelligent chemical utilization of that part of the forest crop which served as a legitimate raw material of the chemical industries. He has also been actively interested in saving forest wastes. Through his instrumentality forest products have been converted into the most varied articles of every-day commerce, and wastes have been utilized in the most unlooked-for ways. As a direct result of his painstaking studies, the stumps on that cut-over southern pine areas have been reclaimed for the production of solvent oils, turpentine and resins, wrapping paper, and the myriad products of wood distillation. Through his efforts other pine wastes have been converted into cattle feed, spruce wood into artificial silk and western larch into ethyl alcohol. Through his investigations, beech, maple, and birch have been changed into a vast number of drugs, dye-stuffs, photographers' films, and synthetic resins.

But the chemist has done infinitely more than this in his service to the forester. He has had the vision to see that those fundamental studies which underlie the entire field of practical forest chemistry must be undertaken and pushed to the utmost before this phase of forest utilization could advance beyond the stage of industrial empiricism.

For there are two general types of problems that confront the forest chemist of today: (*a*) those which deal with the chemical utilization of the forest crop and forest wastes, and (*b*) those which have to do with

the chemical mechanism of tree growth and with the chemical constitution of the substances formed during growth. These two types of problems are in fact inter-related and although the more obvious ones are those which fall into class (a), it is impossible to separate the technical problems from those of the pure scientist.

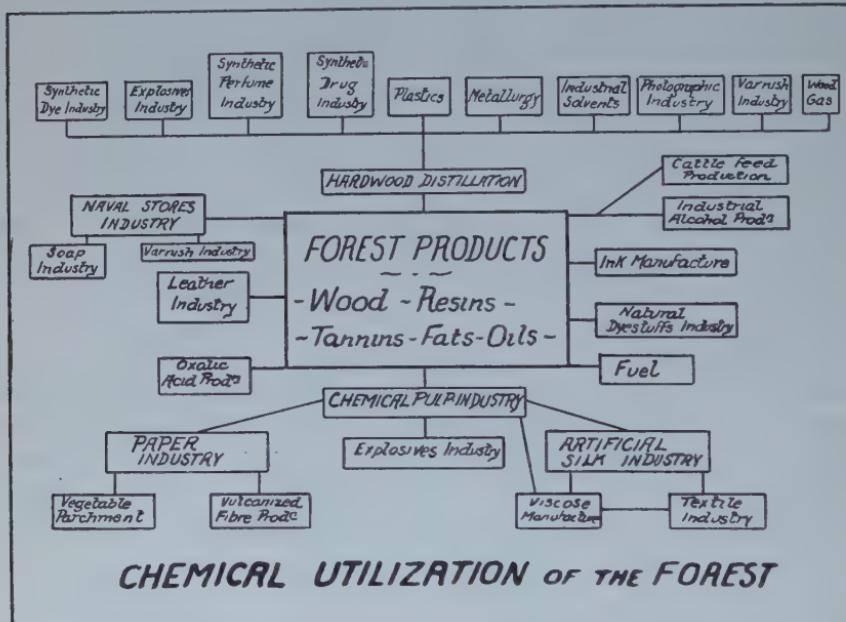


FIG. 1.—Chemical utilization of the forest.—The principal industries partially or wholly dependent on the chemical utilization of the forest, indicating the interrelationship of these industries.

As I have said, the industrial problems are the ones most easily recognized. They are the technological problems of the pulp and paper industry, the wood distillation industry, the naval stores industry, the artificial silk industry, and numerous minor enterprises which utilize wood and other forest products, such as the natural dyestuffs, fats, and oils. The practical value of such investigations are easily visible. It is not difficult, for example, to recognize the difference between the cumbersome, wasteful methods of charcoal production of the "coallier" with the effective Stafford wood distillation process of today. The chemist and chemical engineer have been instrumental in condensing and utilizing the waste products which the "coallier" allowed to burn or to escape into the air, and in making use of much of the heat given off in the distillation process.

Nor is it difficult to follow the great strides made in the pulp and paper industry. With the exploitation of Benjamin Tilghman's sulphite pulp process, in which coniferous woods of low resin contents were converted into pulp by the action of sulphurous acid and calcium acid sulphite, the use of wood as the raw material of the chemical pulp industry was firmly established. Today every step in the manufacture of pulp and paper has received the attention of an army of chemical investigators and many classes of paper have been studied and standardized by the chemists.

Similarly the "viscose" artificial silk industry is dependent on the researches of chemists. In fact it grew directly out of the discovery made by two British chemists—Cross and Bevan—that wood pulp or cotton linters when macerated with alkali, and subsequently treated with carbon-bisulfide yielded a water or alkali soluble material. The resultant ill-smelling solution could be purified and after suitable periods could be forced through miniature openings into coagulating baths, which converted the solution into a fine thread of silk-like luster. This "artificial silk" (or viscose as it was termed) could be easily and brilliantly dyed and had sufficient strength to insure its use in the textile industries. Since this initial discovery, chemical researches on viscose have given rise to a stronger and better grade of artificial silk, and the industry has grown to such proportions that today it is firmly established in most civilized countries. Thousands of fiber silk neckties and sweaters, hundreds of thousands of viscose silk socks and stockings, which found their origin in the coniferous forests, are being annually produced and consumed.

In the main, the examples referred to are practical ones which shall meet with the response and interest of the manufacturer and the industrialist. However, the problems of the pure scientist in connection with forest chemistry are much more subtle, and their importance is much less obvious to the casual observer. To the business man they may perhaps appear academic and a bit abstruse. In reality they are the most vital and fundamental problems in forestry which the chemist has to face, and their solution will supply basic data on which will rest the security of future forest industries.

It is well in this connection to remember that the pure scientist of today frequently supplies the raw material for the civilization of tomorrow. Faraday's classical experiments in electricity were scoffed at by the statesman Gladstone, yet they laid the cornerstone of the modern

electrical engineering. Hertz, the youthful professor of physics at the University of Bonn, "played" with the electromagnetic waves which later found their utilization in the wireless telegraph and the "radio."

Some of these fundamental problems cannot be popularized any more readily than they can be solved, but it is not impossible to show that their pursuit may have an important industrial bearing. In the paper industry the great raw material is wood pulp, consisting very largely of the substance cellulose. Strange to relate, the chemist has by no means solved the riddle of the chemical constitution of this abundant material, cellulose, which forms about 50 per cent of the dry weight of all woods. Nor has the chemist definitely determined whether the cellulose of one wood is chemically the same as the cellulose of another wood. These are problems which are crying for solution, and which *pure* scientists (*not industrial chemists* interested in forest products) are striving to answer. Recently a long-headed, practical industrialist stated that in his estimation the outstanding problem in the pulp and paper industry of today was that of the chemical constitution of cellulose.

Another problem which fosters a friendly international rivalry between chemists may be phrased in the question: "What is the chemical nature of lignin and what chemical and physical processes lead to its formation in the growth of wood?" About 25 to 30 per cent of average, dry wood is this so-called "lignin," a strange mixture of products which encrusts the cellulose of the woody cells of the tree. The chemical pulp manufacturer removes this lignin when he produces "sulfite" or "soda" pulp. Lignin must be absent from high-grade bond and book papers, although it is always present in ordinary newspaper. When it is chemically removed it is either destroyed or wasted, and the chemist is still in the dark regarding its true composition and its intrinsic properties.

Similarly many other fundamental questions connected with growth of wood and the chemistry of forest products have demanded and are demanding the earnest attention of the scientific investigator. What is the chemical nature of the dyestuffs and tannins which are present in the bark and wood of trees and what is their function in the plant? What is the nature of the important coloring matter of the leaf? What types of resins, fats, waxes, and oils exist in various trees, and what is the "chemical" reason for their existence? What is the true chemical nature of the "cell sap" and what is the mechanism by which this sap builds up "living" plant cells? What is the chemical co-relation between forest soils and forest growth? What are the chemical changes wrought

in the wood when it decays and when it is attacked by insects? Some of these fascinating questions have been partially answered. Others are still puzzling the forest chemist. In many cases investigators still lack the methods and tools with which to attack their problems. Often they are doing laborious pioneer work in obscure and hidden fields.

The layman, even if he does not always fully grasp the significance of such problems, must lend his sympathy and moral support to the scientist before the latter can reach his goal.

Only one more thought would we wish to leave with our reader. Obviously, the investigations of the chemist are not confined to one nation or to one race. Like all the products of science, they have become international, but we are proud to say that American forest chemists are in the van. In the United States the Forest Products Laboratory, a powerful arm of the Forest Service in the Federal Department of Agriculture, is *the* outstanding research institution. It is ideally located at Madison, Wisconsin, and during its eleven brief years of healthy growth its contributions to the chemistry of forest products, and its service to the wood-using industries as well as to pure science, have been little short of phenomenal. In America, also, many private industrial laboratories, large and small, and the chemical departments of various colleges and universities have made significant contributions to forest chemistry. The Forest Chemistry Laboratories of the New York State College of Forestry have inaugurated researches on wood cellulose, as well as on a few of the more urgent technical problems of the pulp and paper industry. Canada has an excellent and productive Forest Products Laboratory at Montreal. In Sweden, a country ever interested in the scientific exploitation of the forest, individual chemical investigators at the Forestry Institute of Stockholm have gained international fame, especially because of their studies of the mysterious lignin. In England a number of cellulose chemists have contributed through their extensive investigations to the pulp and artificial silk industries. Germany has a hustling experiment station for wood and cellulose chemistry at Eberswalde, an excellent laboratory at Darmstadt, empowered to study, among other problems, the chemistry of wood, and a host of brilliant individual investigators at the larger universities who are keenly interested in cellulose. Italy has its experiment station. India is supplied with a splendidly equipped, ably staffed Forest Research Institute and College at Dehra Dun, which is contributing at an amazing rate to

our basic knowledge of the chemistry of fats, waxes, resins, and oils of the Indian forests. Australia, the Philippines, and Japan are also making noteworthy contributions to the progress of forest chemistry. This brief survey is far from being all inclusive. Everywhere chemists are alive to the possibilities of the forests. In all corners of the earth they are quietly studying fundamentals—working diligently and faithfully to understand and to utilize intelligently the chemical products derived from wood.

INVESTIGATION OF TAPER AS A FACTOR IN MEASUREMENT OF STANDING TIMBER¹

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The investigation of taper as a factor in measurement of standing timber is still in progress. This paper does not cover all the ground investigated, but attempts solely to show the conclusions already arrived at for five of the main species in the East, and to show the application of these conclusions to commercial estimates.

The use of volume tables is now general in Canada. A very great deal of energy has been expended by different organizations to develop volume tables for their own use in particular localities; these tables are generally based on measurement of logs, ties or some other product, in the course of a cutting operation. The measurements are made for the preparation of a volume table for the particular product concerned and the resulting volume tables are generally of use only for the locality or type in which the measurements are taken and their value may be nil once the timber in that locality is cut or burnt over. If taper tables are developed from the measurements taken, volume tables can be prepared in terms of other products when desired and comparisons with volume tables of other species or of the same species in other localities are facilitated. The reason that local volume tables are necessary is that one volume table for a certain species in one locality, may give an entirely different series of volumes to the volumes given by another table prepared for the same species but in another locality.

Early volume tables were based on diameter only. Local differences in average height for a given diameter might cause great differences in volume for two localities. The adoption of volume tables based on diameter and height has eliminated height as a contributing cause of differences in volume. Volume differences still occur. The used

¹ Read before the Canadian Society of Forest Engineers, Montreal, January 24, 1923.

References: Chapman, Forest Mensuration, Chapter XVI. Wallin, JOURNAL OF FORESTRY, May, 1918, and April, 1920. Wickenden, JOURNAL OF FORESTRY, October, 1921.

top diameter and stump height are contributing causes to these differences. Another contributing cause is the necessity for expressing volumes inside bark for a given diameter breast high outside bark, resulting in possible differences in volume, due to proper provision not having been made for differences of bark thickness.

It is possible to make due allowances for these causes of differences, and if they are eliminated, any differences between volume tables based on diameter and height must be ascribed to differences of taper or form. The purpose of this investigation has been to develop a method of making provision in volume tables for differences in taper. If it were not for differences in logging practice and if it were not for the necessity of having volumes inside bark for diameter breast height outside bark, we might be able to prepare universal volume tables, but under the conditions that exist, there will be a need for local volume tables. The problem, as I see it, is not to make any attempt to do away with local tables, but to investigate the possibility of developing general taper tables for all species, for groups of species or for individual species, from which we can readily develop local or regional volume tables as they are required. These taper tables would be developed in series, one for each of the classes of taper we would wish to separate.

As a preliminary to any investigation of taper as a factor of volume, we must find some simple means of expressing taper, in the same way that we express diameter as diameter at breast height in inches or height as total height in feet,

Jonson has found that it is possible to express the taper of forest trees in Sweden by means of a formula. He found also that for a given value of the absolute form quotient, taper of Swedish species is constant. It follows that the values of the absolute form quotient can be used as an expression of taper. The absolute form quotient is obtained by dividing diameter at breast height into diameter at half the height above breast height.

We group diameter by one-inch or two-inch classes and heights by five or ten foot classes. Similarly, we group taper classes or form classes, basing our classification on the value of the absolute form quotient. It is convenient to refer to these form classes as percentages, so that we would speak of form class 60, 65, 70 and so on.

In the application of volume tables based on diameter and height, we must make some determination of diameter and height of the timber

to be estimated; in the same way, if we are applying volume tables based on form class, we must determine the form class of the timber to be estimated.

The above is a very brief statement of the general problem in any investigation of taper as a factor in estimating timber.

The specific problems that we have investigated are:

First, to determine whether, for a given form class, the taper of all Canadian species is constant, and if not, to determine whether it is possible to establish a constant taper for each species or for groups of species, so that one taper table based on diameter, height and form class, may be applied over the whole range of each species or group of species.

Second, to develop a method of determining average form class of the timber to be estimated, so that the proper form class volume table may be applied.

The investigation has been carried on in different parts of Canada for the majority of the main species. The following summary shows the species studied and the localities in which each species was investigated:

White pine—

Six localities in Ontario.

Red pine—

Two localities in Ontario.

Jack pine—

Three localities in Ontario.

Two localities in Manitoba.

One locality in Saskatchewan.

Lodgepole pine—

One locality in Alberta.

One locality in British Columbia.

White spruce—

Two localities in Quebec.

Two localities in New Brunswick.

One locality in Ontario.

Two localities in Manitoba.

Two localities in Alberta.

Red spruce—

Two localities in New Brunswick.

Black spruce—

Two localities in Quebec.

Three localities in New Brunswick.

Two localities in Ontario.

One locality in Manitoba.

Balsam—

Three localities in Quebec.

Three localities in New Brunswick.

One locality in Manitoba.

The first specific problem involves measurements of taper on felled sample trees. Jonson's formula, referred to above, gives the diameter at any point on the stem, expressed as a ratio of the diameter at breast height; it is convenient to show the taper as a series of diameters at breast height and at each tenth part of the stem length above breast height, these diameters being expressed as percentages of dia-

ter at breast height; these series may be referred to as the percentage taper curve, or more briefly, the taper curve.

Measurements of taper have been made on felled trees in each locality investigated, about 5,000 trees in all. The measurements for each tree have been converted into percentage taper curves, the curves have been grouped according to form class and averaged, and the average percentage taper curves for each species and locality have been compared with the corresponding average curves from the measurements on other species or on the same species in other localities. This work has shown that the taper curve within a given form class, varies with species, with diameter or with age and probably with height also. That is to say, the taper curve for white pine is different to the taper curve for white spruce, the taper curve for 8-inch white pine is different to that for 20-inch white pine and the taper of 30-year-old pine is different from that of 200-year-old pine.

It has been suggested that these variations in taper might be due to the effect of root swelling on d. b. h. and that it might be possible to make corrections accordingly. It is certain that variations in taper do occur without root swelling and there was no evidence of root swelling affecting d. b. h. in any of the material examined; even if some of these variations are due to root swelling, as long as the variations are constant in the same species, as they are, there is no need to make any provision for this.

Differences of taper due to species may cause differences in board foot volume up to 8 per cent, and differences in taper due to differences in size may cause differences in volume as high as 12 or 15 per cent. There seems, therefore, to be need for development of separate taper tables for different species or groups of species and for different size or age classes in the same species. Comparisons were made of taper curves for different species and localities for the same broad diameter classes, with the object of determining whether a general taper curve for one species or for any group of species could be applied over the whole range of that species or group of species. The results from this work have been entirely satisfactory.

This work has shown that separate general taper tables can be applied to the following species in the regions noted, the conclusions being based on measurements of trees in a number of localities:

Balsam.—In Quebec, New Brunswick, and Manitoba, 7 localities examined.

White spruce, red spruce, and black spruce.—In Quebec, New Brunswick, Ontario, and Manitoba, 11 localities examined.

White pine.—120 years old and over, that is, in saw log timber. In Ontario, 6 localities examined.

These taper tables will be found in Appendix A.

The individual taper curves in the general taper tables have been derived from the local figures for the different species examined. It appears that age, diameter or height may cause differences in taper and the various localities were selected to cover, for each species, the range of these conditions that have any commercial importance. It was found that local variations for all sizes of balsam, all sizes or white, red and black spruce, and for white pine, 120 years old and over, were small enough to warrant general taper tables being prepared for these three groups. Local taper has been compared with the general taper. Calculations have been made of the difference between volume from the general taper tables, for different form and diameter classes, and volume from local taper, in the corresponding form and diameter classes; in the case of white, red, and black spruce and balsam, the variation in cubic foot volume for any species and locality does not exceed 5 per cent, in the case of white pine this variation does not exceed 5 per cent of board foot volume. The general taper tables are subject to some modification as further local material accumulates, but, since the range of localities on which the general tables are based includes the conditions met with in commercial practice, it is believed that any modification in the general tables will be within the range of error indicated above.

These general taper tables are arranged in form classes, a different taper table for each form class; from these taper tables we can readily develop volume tables in board feet, cubic feet, ties or in terms of any product desired; these volume tables can be prepared for any stump height and merchantable top diameter and for the breast high bark thickness of the species concerned. These volume tables, like the taper tables, are arranged in form classes, and in order to apply them we must determine the average form class of the timber to be estimated. The development of a method of determining average form class is the second specific problem investigated.

As might be expected, there is considerable variation in the form class of individual trees in a stand of timber. However, we do not apply different form class tables to individual trees, but we apply to

the whole estimate the table corresponding to the average form class of the timber.

In timber of the same type, even though it is very irregular, the distribution or dispersion of individual form classes follows a certain definite law. This dispersion is wide in irregular stands, such as occur in cut over pulp lands of Quebec, and narrow in uniform timber, such as lodgepole pine in Alberta. Any average form class we determine would be based on sample trees, and the average of our sample trees is liable to be closer to the true average form class in regular than in irregular stands. The dispersion of form classes can be measured and it can be shown that for cut over or virgin pulp lands in Quebec, for instance, the measurement of form class of 40 or 50, systematically selected trees, will give an average form class, such that any error in cubic volume, due to error in estimation of form class, will certainly not exceed 4 per cent and is unlikely to exceed 2 per cent. In case of certain species that grow in regular even aged stands, such as white and red pine, jack pine or slow growing black spruce, it appears that, after a certain age is reached, the average form class may be uniform throughout the range of the species. In the six localities in which measurements of white pine were made, and in seven localities for slow growing black spruce, it was found that the application of a general form class value would involve an error in cubic foot volume not exceeding 3 per cent, or in board foot volume not exceeding 6 per cent, in any one case. In the case of both species it is possible to separate average form class values for open grown and for thickly grown timber and thus reduce the range of error still further. Not enough measurements have been made for other species to draw any conclusions, but it seems reasonable to suppose that it will be possible to establish a similar relation between type and form class for other species also. When this relation between type and form class has been established, the proper form class can be applied without any preliminary estimation of average form class whatsoever.

In the seven localities in which slow-growing black spruce was examined, it was found that the average form class varied round 68, was not less than 66 and did not exceed 69. Form class of white pine, 120 years old and over, was examined in five localities; it was found that the average form class of pine in mixed or pure stands was not less than 69 and not greater than 70. The form class of white pine growing singly, with completely free crown, was found to vary round 67. The quantity of timber of this latter type forms generally only

a small proportion of the timber to be estimated and it appears as if the average form class of 70 might be used in most cases as a general form class value for the whole estimate.

The method adopted in Sweden for determination of average form class is based on the relation between form class and the height in the tree of the point at which the wind exerts its maximum pressure. This point has been called the form point. It has been found in Sweden that for the types of timber there, the average form class can be determined with reasonable accuracy. H. R. Wickenden, of the Wayagamack Pulp and Paper Company, states that he found the method successful in the estimation of timber in Quebec. We have estimated form point for about 4,000 trees measured for form class and have endeavored to relate average form class for each locality with average form point. Each average is based on measurement of at least 100 trees, and averages for 34 localities have been compared. We have not secured very satisfactory results. There does appear to be a relation between average form class and form point, but this relation is not very strongly defined and it appears as if the application of the method might lead to errors in estimation of cubic volume of at least 10 or 12 per cent, or about 20 per cent of board foot volume.

Since there seems to be some difficulty in the way of applying to our numerous species in Canada the Swedish method of determining average form class, it will be necessary to use some other method. Where average form class is uniform for the same type over the range of the species, as it appears to be for white pine and slow growing black spruce, we may be able to apply the proper form class table at once. Failing this condition, it seems that the most satisfactory method of determining form class is to measure directly form class of 40 to 50 trees of each species in each broad type in the timber to be estimated. An illustration will make this clear. On the Pejepscot Company's holdings near St. John, N. B., there are three main types of red spruce, old field spruce up to 100 years old, mature thrifty spruce 150 years old, and over-mature spruce with more or less stagnated growth, 200 to 250 years old. These three types are separated in the Company's estimates. In order to determine average form class it would be necessary to measure form class of 40 to 50 trees in each type. These 40 to 50 trees would be systematically selected and measured in the course of strip survey, or, if no strip survey were carried on, representative trees could be selected and measured in

different parts of the limits. The tree must be felled and inside bark diameter measurements made at breast height and at a point in the stem midway between breast height and the top of the tree. At the same time measurements could be made of bark thickness and data could be collected for a diameter height curve.

I have made a number of statements as to the accuracy of estimations of volume derived from general taper curves; the comparisons made are comparisons of averages. The use of averages as a basis for argument is limited in several ways and before averages are used for this purpose, they should be subjected to examination by statistical methods. I have made some study of the use of statistical methods in forest investigating work—and in commercial work also—and I have been assured that my application of the statistical methods I have used is sound. All the work that I have reviewed has been subjected to careful examination by statistical methods and the conclusions drawn as to relative accuracy of volume tables based on general taper tables are justified. Professor Donald Bruce has suggested a standard method of checking volume tables, based on a comparison of scale of base trees with volumes of the same trees from the volume table to be checked. (*JOURNAL OF FORESTRY*, May, 1920.) Since volume tables are based on averages, the volumes of base trees will not check completely with the corresponding volumes in the volume tables; there is a certain definite law governing the distribution of variations of individual tree volumes, the same law that governs the distribution of form classes or of diameter classes of trees in a forest. This distribution can be expressed mathematically and the relative accuracy of two or more volume tables can be calculated. A check on these lines of some of the work done is now in progress.

In conclusion, I will summarize the results we have achieved:

It seems that a universal volume table is hardly practicable and that the use of local or regional volume tables is necessary. It is certain, however, that general taper tables can be prepared for individual species or for groups of species, and the use of these general taper tables will very much simplify the preparation of local volume tables. We have general taper tables for white pine, balsam, white spruce, red spruce, and black spruce. From these tables we can prepare local volume tables as desired; these tables will be based on diameter, height and form class and volumes will be inside bark for diameter breast height outside bark. Preparation of the volume tables can be completed without any further requirements than the following:

1. Decision as to merchantable top diameter and stump height.
2. Measurement of average bark thickness at breast height of a number of trees in the types to be estimated. As local experience is gathered, measurement of bark thickness may be dispensed with.
3. Development of diameter height curve by measurement of heights and diameters at breast height of a certain number of trees.
4. Measurement of form class on 40 to 50 trees for each local volume table prepared. It appears that this measurement may be dispensed with as experience is gained as to the relation between type and form class.

These are the only requirements for the preparation of local or regional volume tables. The work necessary is very much less than is involved in the preparation of local tables by previous methods. These methods require measurement of log scale of a large number of trees in a cutting operation, and we have no certainty that the resulting volume table will apply to the timber to be estimated. The few measurements necessary for development of a volume table from general taper tables are made on the timber to be estimated and we have that much assurance that the resulting volume table does apply to the timber for which the estimate is desired.

APPENDIX A GENERAL TAPER TABLES

These general taper tables are based on average figures for taper of the different species in the various localities examined.

The taper is expressed as a series of diameters at breast height and at each tenth part of the length of the stem above breast height, the diameters being expressed as percentages of diameter at breast height.

The taper tables are arranged in form classes; the range of form classes shown is wide enough to include any average form class met with in the species concerned.

Except in the balsam taper table, different taper curves are provided for different broad diameter classes. The balsam taper table applies to trees up to 15 inches in diameter. It was found that the differences in taper between small and large trees within this limit were so small as to be indefinite; accordingly, only one taper curve for all diameter classes within this limit is shown. The broad diameter classes shown are separated on the basis of the general distribution

of diameter classes in the forest. There is only a small representation of trees falling in the lower or upper extremes of the diameter classes separated, and in the event of the taper of these trees being different from that shown in the tables; the effect of differences in taper in these trees on the total volume of the timber estimated would be small, and may be neglected.

Local volume tables can be prepared from these taper tables as desired. The following are the requirements in preparation of a local volume table.

1. Decision as to merchantable top diameter and stump height.
2. Development of breast-high bark thickness curve.
3. Development of diameter height curve.
4. Determination of average form class of the timber to be estimated.
5. Development of volume table in the required log rule from the general taper tables. This involves conversion of percentage taper curves shown in the taper tables to taper curves expressed in terms of inches of d.b.h. and feet of height, to correspond with the various diameter and height classes for which the volume table is to be prepared. There are several methods of developing volume tables from these taper curves, but the method illustrated in Appendix B is satisfactory and may be recommended.

The general taper tables are shown below.

Balsam.—Based on measurement of 362 trees in the following localities: Quebec—Gaspe County, Champlain County, Chicoutimi County. New Brunswick—Northumberland County, York County, St. John County. Manitoba—East of Lake Winnipeg.

Height in tenths of length of stem above breast height	Form class 60	Form class 65	Form class 70	Form class 75
D. b. h.....	100.0	100.0	100.0	100.0
1st tenth.....	93.3	94.0	95.0	95.8
2d tenth.....	86.9	88.2	89.8	91.6
3d tenth.....	79.4	82.0	84.0	87.3
4th tenth.....	70.5	74.6	77.5	81.8
5th tenth.....	60.0	65.0	70.0	75.0
6th tenth.....	49.3	54.4	59.0	65.1
7th tenth.....	38.0	42.2	46.6	53.0
8th tenth.....	26.1	29.5	33.0	38.7
9th tenth.....	13.4	15.5	17.9	22.0
Top of tree.....	.....	.....	.....	.....

Diameters at breast height and at each tenth part of stem above breast height. Diameters are expressed as percentages of d. b. h.

White Spruce, Red Spruce and Black Spruce.—Based on measurement of 865 trees in the following localities: Quebec—Gaspe County, Champlain County, Chicoutimi County. New Brunswick—Northumberland County, Gloucester County, York County, St. John County. Ontario—Measurements made on slow growing black spruce only: Renfrew County, Kenora District. Manitoba—Riding Mountain, east of Lake Winnipeg.

Height in tenths of length of stem above breast height	Form class 60		Form class 65		Form class 70		Form class 75	
	A	B	A	B	A	B	A	B
D. b. h.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1st tenth	91.1	90.4	93.8	90.9	94.7	92.0	95.4	94.5
2d tenth	84.0	83.7	88.0	85.2	89.4	87.3	91.3	90.7
3d tenth	77.3	76.3	81.5	79.3	83.8	82.2	86.8	86.4
4th tenth	69.6	68.5	73.9	73.1	77.4	76.9	81.5	81.8
5th tenth	60.0	60.0	65.0	65.0	70.0	70.0	75.0	75.0
6th tenth	50.0	50.3	55.3	55.8	60.2	60.2	66.5	65.5
7th tenth	39.0	39.9	44.1	44.9	48.5	49.0	54.9	54.0
8th tenth	27.0	28.0	31.6	32.4	35.2	36.0	40.8	40.0
9th tenth	14.4	15.3	17.2	18.0	20.0	20.0	23.2	23.4
Top of tree								

Diameters at breast height and at each tenth part of stem above breast height.
Diameters are expressed as percentages of d. b. h.

Columns marked A are for diameter classes falling below the 10-inch class.

Columns marked B are for diameter classes falling into the 10-inch class and above.

White Pine (120 years old and older).—Based on measurement of 342 trees in the following localities: Ontario—Nipissing District, three localities. Parry Sound District. Rainy River District, two localities.

Height in tenths of length of stem above breast height	Form class 65			Form class 70			Form class 75		
	A	B	C	A	B	C	A	B	C
D. b. h.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1st tenth	90.5	89.3	87.2	93.2	90.7	89.5	94.6	93.5	91.0
2d tenth	83.8	83.5	82.4	88.0	85.7	85.3	90.2	89.3	87.4
3d tenth	78.3	78.2	77.3	82.8	81.3	81.0	86.0	85.5	83.8
4th tenth	72.2	72.1	71.8	77.0	76.2	76.0	81.1	81.1	80.0
5th tenth	65.0	65.0	65.0	70.0	70.0	70.0	75.0	75.0	75.0
6th tenth	57.5	57.0	56.6	61.3	61.7	62.0	66.4	66.3	67.0
7th tenth	48.2	46.8	46.0	50.6	51.0	51.5	55.0	55.0	55.2
8th tenth	35.4	33.2	32.5	37.0	37.0	37.8	40.5	40.1	40.6
9th tenth	18.9	17.0	16.9	20.0	19.4	20.0	22.3	21.5	22.0
Top of tree									

Diameters at breast height and at each tenth part of stem above breast height.
Diameters are expressed as percentages of d. b. h.

Columns marked A are for diameter classes below the 15-inch class.

Columns marked B are for diameter classes falling between the 15-inch and 19-inch diameter classes inclusive.

Columns marked C are for diameter classes falling into the 20-inch class and above.

APPENDIX B

The following example will illustrate the method of developing a volume table from the general taper table.

The object is to develop a volume table in board feet, Doyle Rule, for white pine 120 years and older, form class 70, from the general taper table for that species and type. For the diameter classes below the 15-inch class, use taper curve A; for diameter classes between 15 and 19 inches, inclusive, use taper curve B; and for diameter classes in the 20-inch class and above, use taper curve C.

Plot the taper curves on cross section paper. From the data procured prepare curves showing—

(1) Relation diameter breast high outside bark to diameter breast high inside bark.

(2) Relation top diameter used inside bark to diameter breast high outside bark or inside bark.

Fill in and complete the following form for each diameter class and height class required to complete the volume table.

As an illustration of the operation, the table is completed for a tree 18 inches d. b. h. o. b. and 90 feet high.

Form for Development of Volume Table

Species	White pine
Form class.....	70
Diameter class.....	18 inches
Height class.....	.90 feet
Log rule.....	Doyle
Log length with over-run.....	16.3 feet
Stump height.....	1.5 feet
1. Diameter breast high outside bark.....	18 inches
2. Diameter breast high inside bark.....	16.7 inches
3. Height of tree above ground.....	.90 feet
4. Height of tree above breast high.....	.83.5 feet
5. Length of section, stump to breast height.....	3.0 feet
6. Length of section stump to breast height expressed as percentage of height above breast height.....	3.5 per cent
7. Express half log length (8.15 feet) as percentage of height above breast height.....	9.5 per cent
8. Half of above.....	4.8 per cent
9. Merchantable top diameter inside bark.....	7.5 inches
10. Merchantable top diameter inside bark as percentage of diameter breast high inside bark.....	44.9 per cent

11. Deduct percentage length section stump to breast height (6) from percentage half log length (7).....6.0 per cent
12. Read off on plotted percentage taper curve the percentage height above breast height of merchantable top diameter inside bark (10)74.0 per cent
13. Set down the heights of tops of successive half logs, these heights expressed as percentages of height above breast height; make top of last log less than half of half log length (8) from percentage height of merchantable top diameter above breast height (12).
14. Read off on the plotted percentage taper curve the percentage diameters at these heights.
15. Convert these percentage diameters to inches by multiplying diameter at breast height inside bark by the corresponding percentage diameter.
16. Read off on the log rule the volume of each complete or half log for the top diameters shown; add the log volumes to get volume of tree. The work for 13, 14, 15, and 16 is illustrated below:

$\frac{1}{2}$ logs	Item 13	Item 14	Item 15	Item 16
		<i>Per cent</i>	<i>Inches</i>	
1st	6.0			
2d	15.5	88.1	14.7	16-foot log, 115 board feet
3d	25.0			
4th	34.5	79.2	13.2	16-foot log, 86 board feet
5th	44.0			
6th	53.5	67.2	11.2	16-foot log, 51 board feet
7th	63.0			
8th	72.5	47.3	7.9	16-foot log, 16 board feet
				267 board feet

Total volume for tree 18 inches d. b. h. o. b. and 90 feet high—267 board feet, Doyle rule.

DIVISION OF THE NATIONAL FORESTS INTO WORKING CIRCLES

By JOHN F. PRESTON AND I. F. ELDREDGE

It goes without saying that to practice forestry you must first have a forest—it is equally true that before a workable plan of management of forest resources can be made, there must be a clear-cut and definite decision as to the area of forest to be included in the provisions of the plan. This management area is the working circle.

Very rarely will any two foresters be found who have exactly the same conception of a working circle. Text books usually define it rather vaguely as a unit of forest managed under one working plan. The words are plain enough, but somehow they do not satisfy the man who is out looking for a working circle in his forest and feels the urgent need of having some means of identification in the event that he should meet one. Perhaps the best way to throw some light on the subject, as it pertains to the work of the Forest Service, is to discuss the factors which are usually taken into account in dividing a National Forest into working circles. The following are not all of the factors which have a bearing on the question, but they are perhaps the ones most commonly encountered under present conditions.

TOPOGRAPHY

The most natural, permanent, and obvious division of a forested territory into working circles is on the basis of topography. The presence of high and rugged mountain ranges often limits the size of a working circle by boxing in the territory accessible to any one system of transportation. Ideally, the drainage system of a considerable stream or a smaller drainage basin constitutes the logical territory for a working circle. If other considerations permit the division to be made purely on the basis of topography, the problem is simple, but not always can this be done. Often the topography presents no very natural lines of demarcation or transportation systems have been built so as to largely overcome the natural obstacles. Frequently the status of ownership or condition of the timber does not permit so simple a

solution. Topography is generally the most important of the many factors that must be considered, because where the terrain is at all rough it may affect many of the other important considerations. In any case, before decision is made the other factors involved must be carefully examined and weighed.

TRANSPORTATION

The next most obvious and important factor is that of transportation. Existing, proposed, or obviously indicated systems of transportation often (together with topography) indicate the location and delineate the boundaries of working circles. All of the territory tributary to a rail head tapping the forest might logically be included in one working circle. The same might be true of the territory adjacent to a drivable stream. Sometimes working circles must be laid out in advance of the development of any system of transportation. In this case the study of the topography may indicate the transportation development to be expected, and this might be used as a basis for division.

OBJECTS OF MANAGEMENT

Some of the objects of management have a very important bearing on the size and location of a working circle. If sustained yield, for instance, is the objective, the circle must contain a sufficient volume of timber of the right age classes to maintain a continuous production. If periodic yield is satisfactory, topography and transportation alone may decide the question. A high quality product, involving a long rotation, will require more productive area than the same volume of output in a low quality product. If timber production is the sole consideration the layout of working circles might be quite different than if recreation or other forms of use assumed considerable importance.

It may be the policy of the Government to maintain forest communities now in existence or to make possible the development of such communities within or adjoining a National Forest. The size, location, and character of a working circle will be greatly influenced by the needs of the community. The cut, other things being equal, must be large enough to employ regularly and at the strategic locations a sufficient amount of labor to maintain the families making up the community wholly or partially through the year. Obviously, too, if such communities are to be permanent there must be sustained yield, which

fact in itself will have an important influence upon the size of the working circle. To meet the needs of the community it may, perhaps, be necessary to produce from the Forest certain commodities, as for instance ties or minor forest products, upon which community welfare may depend. The character of the demands may cause quite a difference in the location and size of the working circles.

SIZE AND CHARACTER OF INVESTMENT FOR UTILIZATION

The working circle must be of a size to contain a sufficient volume of timber to permit an annual cut large enough to enable manufacture or logging, if it is a separate activity, to be carried on on a practicable scale, that is, on a scale commensurate with the investment in equipment and improvements. This factor alone often dictates the minimum size of the working circle. It may be larger, due to the influence of other factors, but certainly it cannot be smaller than required to supply an output large enough for the minimum sized operation, unless it is possible and desirable to provide the supply for a manufacturing center on the intermittent yield principle from two or more circles.

COMPOSITION AND CONDITION OF THE STAND

The distribution of age classes and the silvicultural condition of the timber may have a very important bearing on the size of a working circle and the location of its boundaries. In most of the National Forests there is found a great preponderance of the oldest and the youngest age classes with a corresponding shortage of the middle age classes. In order to work out a sustained yield and to obviate any extended hiatus in the flow of the forest products from a given territory, it is often necessary to extend the boundaries of a working circle to make up the deficiency in the middle age classes. This often necessitates larger working circles than would otherwise be required. It sometimes happens that the presence of a large volume of unmerchantable species mixed with the merchantable species requires adjustment in the size of the working circle in order to produce a practicable sized annual cut of merchantable timber. It is obvious that the presence of barren land or burned land not restocking will increase the size of a working circle if such lands cannot be segregated and thrown off to themselves.

OWNERSHIP

The effect of ownership of the land may have a very decided effect upon its division into working circles. There are two schools of thought as to whether alienated land within a working circle should be taken into account in figuring yields or whether it should be excluded from all calculations and the working circle based only on the Government lands or lands over which the Government has complete control so far as management is concerned. Without going into the merits of either school of thought, it is obvious that alienated land must be taken into account in laying out the boundaries of a working circle, whether the yield from it be included in or excluded from the calculations of output for the working circle. If the location and ownership of the alienated land is such that the Government can exercise no control of the rate or time of cutting, it would be unwise to figure any part of the sustained yield from this source. The presence of private timber holdings, however, will give greater elasticity to the cutting plans for Government land and where these are not included in the calculations will at least add a factor of conservatism. If the situation is such that partial or complete control of the time of cutting on the alienated land can be exercised by the United States, then the output of the circle can be figured on the basis of the total productive land irrespective of ownership. Under other conditions the effect of the presence of alienated lands upon the output and therefore upon the size of the working circle is always more or less a matter of conjecture with the result that the area selected is usually larger than would be true if the ownership were not divided.

WORKING CIRCLES' BOUNDARIES NOT PERMANENT

Many of the factors given above are more or less temporary in their influence, and it is to be expected that working circles chosen now will be subject to revision as the governing factors change from time to time. It seems quite certain that there will be a general realignment after the first cutting cycle or, at the latest, after the first rotation, for then our successors will be dealing with both natural and economic conditions very different from those we now have. Undoubtedly, the general tendency is, in the West at least, to lay out working circles at the start that are larger than the future foresters will maintain. The history of logging development in this country and abroad justifies an expectation

that with the disappearance of the vast forests of virgin timber will go the gigantic manufacturing plants which now are so common in our western forest region. The size of the annual cuts required for these large plants forces, in many cases, larger working circles than will be necessary or desirable in the future.

The actual size of working circles in the National Forests of the East varies from 12,000 to 100,000 acres, with an average between 20,000 and 40,000 acres. In the West the areas would be from 100,000 to 500,000 acres, with an average between 150,000 and 250,000 acres. If American forestry demands, with equal intensity of use, as small working circles as does Europe, it would mean eventually something like five working circles in the East and twenty-five in the West where we now have one. Probably such an assumption is entirely wrong. American forestry is being built under economic and forest conditions and with industrial machinery very different from those existing in Europe a century ago. Nevertheless, it seems almost certain that many of the larger working circles must be eventually (with more intensive forestry practice) divided into two or more units of management, and this prospective development should constantly be kept in mind in the preparation of management plans for all working circles.

As soon as we recognize the fact that the present division into working circles is not permanent and that eventually smaller units must be chosen, two things stand out as important in preparation for the future development: (1) the records should be kept for units of area small enough and (where possible) with natural boundaries sufficiently well defined so that further subdivision of the territory will be facilitated. In view of the prospect that they may become the future units of management, the selection of the boundaries of the subdivisions of our present working circles (blocks or compartments) becomes a matter of great importance; (2) the cutting should be distributed over the working circles as widely as possible. If the plan provides, for example, for cutting 1000 acres annually, it should, at as early a time as practicable, be split into two or more cutting areas. Five areas of 200 acres each (instead of one of 1000 acres), in as many different blocks or compartments, would be better business from both the silvicultural and management points of view, and would make possible the later division of the working circle, if found advisable, without serious inconvenience.

POLICY OF FOREST SERVICE

In general, it may be said that the boundaries of working circles should be restricted to include the smallest area considered practicable for management under existing conditions. Present existing conditions should control, however, and not the prophecy of future development, unless such development is reasonably assured.

The Forest Service is committed to a policy of sustained annual yield management wherever the forest resources are susceptible of such management. This is the most important factor, necessitating large working circles during the first rotation. The Service is willing to stand cheerfully any reasonable loss of volume through decay that may be entailed in spreading the cut in mature timber over a long period of time if such a sacrifice will result in a sustained yield. The results of sustained yield management of the National Forests will be permanent forest industry. In laying out working circles and otherwise in considering the fundamentals of forest management, the log industry, rather than the lumber industry—the output of the forest in round timbers rather than in highly finished products—will be the first object. Similarly, the maintenance of forest communities of woods workers, rather than the maintenance of "lumber towns," will be the guiding thought. The accomplishment of these simple objectives will usually meet the public needs fully and protect the "interests of the United States." Occasionally, however, it will be necessary to extend the protecting influence of National Forest management further than the strictly woods industry and tie in the management to the manufacturing unit. This is a dangerous departure from simple principles and leads along a treacherous road, and such a policy should obviously not be adopted except after a clear showing of necessity. These are questions which affect directly the problem of the division of the National Forests into working circles.

It is not unusual to find a tendency on the part of forest officers to solve the problem of sustained yield, particularly where a part of the forest has already been cut over or where an established plant has developed an annual need greater than can be supplied from what otherwise is a natural working circle, by creating a working circle of great size, sometimes throwing a whole forest into a one-management unit. Such a solution may be advisable in rare cases, but on the whole it is far better to stick to a logical division into working circles and let the management plans take care of the facts and conditions.

THE INFERIOR SPECIES IN THE WHITE PINE TYPE IN MONTANA AND IDAHO¹

BY ELERS KOCH

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Throughout the Inland Empire region in northern Idaho and western Montana, the Douglas fir, larch, hemlock and white fir in the National Forests is for the most part worth less than nothing when appraised on a conservative basis of five or six year average lumber prices and operating costs. In other words the cost of logging and milling is greater than the average value received for the lumber, or at least there is not enough margin to yield an adequate return on the investment. In the same region and on the same areas white pine is worth from \$4 to \$12 per thousand and yellow pine from \$2 to \$4.

Considering the fact that yellow pine and white pine amount to only about one-quarter of the total estimated stand of National Forest timber in this region, and considering further that even the best stands are made up of a mixture of the valuable species with the so-called inferior species, the problem of the forester in that region is no easy one.

I have before me three typical appraisals of timber in the white pine type made within the last year in the Pend Oreille, Cabinet, and Coeur d'Alene Forests. In all three cases the appraisal is based on five-year average lumber prices and operating costs for white pine, and six-year average for other species, which was the usual basis of appraisal in 1922. In all cases the cost of logging improvements has been charged entirely against the white pine and yellow pine. The Pend Oreille chance shows an indicated stumpage value of \$5.76 for white pine, \$1.68 per yellow pine, and minus quantities for all other species as follows: Spruce 90 cents, cedar \$4.64, fir and larch \$4.58, white fir and hemlock \$1.48.

The Coeur d'Alene chance shows indicated values of \$7.71 per white pine and minus \$4.98 for white fir. The Cabinet appraisal shows \$5.50 for white pine and minus \$6.60 for fir, larch, and hemlock.

¹ Read before the Northern Rocky Mountain Section, Society of American Foresters, at Missoula, Montana, April 11, 1923.

In other words, all of these chances are worth more for the white pine alone than for the white pine plus all other species. If the mixed species are included in the sale contract and their cutting required, the price on the white pine must be reduced sufficiently to carry the loss on the other species, which often means a reduction of two or three dollars a thousand. The usual practice in Forest Service sales has been to put an arbitrary price of 50 cents per thousand on mixed species and reduce the appraised value of white pine to cover the loss. For instance in the Cabinet appraisal referred to above the white pine showed a value of \$5.50 and the mixed species minus \$6.60, and the mixed species amounted to 20 per cent of the total stand. The price of mixed was placed at 50 cents and the white pine reduced by the following formula: $\frac{20 \times (\$6.60 + 50)}{80} = \1.78 . The adjusted

values were then white pine \$3.72, other species 50 cents per thousand. The apparent solution to this situation is to cut the white pine now and leave the fir, larch, white fir, and hemlock to a later date in the hope that in the course of years, with general increases in timber values, these now inferior species will be worth real money. That is just what a good many northern Idaho lumbermen are now doing. There is, of course, a lot of fir, larch, white fir, and hemlock cut in that region. Some of it is cut under easy logging conditions and returns a small profit. A great deal of it is cut and manufactured at an actual loss. The lumbermen with the hard logging chances, comparable to most National Forest areas are pretty generally leaving a large percentage of mixed species. Two lumber companies in Idaho last year cut 92 and 98 per cent white pine, respectively, and it is a certain thing that no natural stands carry such proportions of white pine.

If we look at the experience of older portions of the country it is easy to believe that the now worthless species will be worth good money in the future. We recall how the early lumbermen in New England culled out the white pine and left the spruce, and now the paper companies are cutting every stick of spruce they can get; how the hemlock was left when the white pine was logged in Pennsylvania and the Lake States; and a later cutting of the hemlock netted more money than the original cut of white pine; how the despised red gum of the South became a valuable wood for furniture and interior finish.

Remembering this past history one cannot doubt that the larch, fir, white fir, and hemlock of Idaho will have a future value. It is reason-

ably certain that most of the private timber in northern Idaho will be gone in thirty years. It is also certain that in less time than that much of the competition of southern pine in the Middle West market will have vanished and that the competing coast fir will be higher in price as the more accessible areas will have been logged off. This means an inevitable increase in value of the Inland Empire mixed species.

There is no doubt that from a purely business standpoint, as it is seen by the average lumberman, it is better to leave the mixed species stand than to practically pay for their removal by reducing the price on the associated white pine. From a forester's standpoint the silvicultural effect has, of course, to be given proper consideration. Keeping in mind the fact that the white pine is a somewhat intolerant tree and that it will not reproduce without a considerable degree of direct light, it is evident that culling the white pine out of a mixed stand would usually result in reproducing the area to the more tolerant species, and eventually the elimination of the most valuable species. Fortunately larch casts a light shade and can usually be left with little disadvantage to white pine reproduction. This is to a less degree true of Douglas fir, and if the stand is not too dense often at least a large percentage of Douglas fir may be left uncut without unfavorably affecting white pine reproduction. Also Douglas fir and larch are long-lived species and in many cases could be left through a full rotation if there were not enough timber left on the logging unit to justify a later operation. A general policy has therefore been adopted in District 1 (the Montana district) in the white pine type of leaving as much of the larch and Douglas fir in the sale area as can be done without unduly shading the ground and preventing white pine reproduction, and further of excluding from the sale boundary all areas containing large percentages of fir and larch. In many areas this means confining the sale to the lower slopes in the strictly white pine type and leaving untouched perhaps as high as 50 per cent of the total stand on the drainage in the fir-larch type on the upper slopes and ridges. This is done in the expectation of a second operation in the same drainage when fir and larch have increased sufficiently in value to justify it.

White fir and hemlock present a much harder problem than Douglas fir and larch. They are both tolerant species, cast a heavy shade, and if left when the white pine is cut out, would largely prevent any white pine reproduction. There is the further difficulty that both species are inclined to be defective. The degree of defect varies considerably with

age and location, but frequently stands are found in which hemlock makes up more than 50 per cent of the gross volume of the stand and is nearly 100 per cent defective. In the Kaniksu Forest west of Priest Lake there is a solid body of two townships of heavy timber which is as hard a nut to crack as any forester ever had presented him. The stand has nearly reached the climax type. There are one or two veteran white pine trees to the acre and the balance of the stand is chiefly made up of big hemlock, hoary with age, and nearly every tree a mere shell. Except in the remote contingency that hemlock bark will have a value for tannin it is hard to see how such a stand, which is occupying a splendid white pine site can ever be put in productive condition.

Even when fairly sound, hemlock and white fir are a problem. Practically all of these species, both sound and defective trees, must be removed with the white pine for silvicultural reasons, and with the present minus values of \$3 to \$6 per thousand their removal places a heavy load on the white pine stumpage. This means in effect actually paying \$3 to \$6 per thousand to have the merchantable hemlock removed. In order to avoid this heavy expense several foresters have advocated a policy of requiring in timber sale contracts that all hemlock both sound and defective above 12 inches d. b. h. be felled, the cost of falling and brush disposal to be charged against white pine, and the removal of any of the hemlock logs be left optional with the purchaser. This plan would reduce the cost of disposing of the hemlock to the cost of falling and brush disposal and would eliminate the \$3 to \$6 loss in logging and manufacturing. From a business standpoint it sounds good if we accept the dictum which I believe originated with Dr. Schenck, "It is better to waste wood than to waste money." Looking at the matter from a broad standpoint, and considering the primary function of the Forest Service to produce timber for the nation, I cannot believe that the Service is justified in permitting the destruction of large quantities of saw timber in order to increase the net stumpage receipts. Rather than do this I should prefer to see the sale of timber by the Forest Service in the white pine type discontinued until hemlock and white fir have a positive value, which is only a matter of time. The policy has therefore been accepted of excluding hemlock and white fir from sale areas as far as possible, but within the sale area requiring utilization of all merchantable trees of these species, and taking the loss in white pine.

Assuming that all sound hemlock and white fir down to 12 inches d. b. h. are to be removed in logging operations, there still remains the question of how best to dispose of the defective trees and the more or less suppressed hemlock reproduction which may have come up under the shade of the virgin stand and which often covers the ground densely in the form of flat crowned umbrella shaped saplings 10 or 15 feet high. As stated before it is necessary to get rid of most of this in order to secure white pine reproduction, but the cost of such silvicultural measures is often staggering.

Considerable experimental work has been done to ascertain the cheapest and most effective method of getting rid of defective hemlock and white fir. In general there seem to be four possible methods: (1) Girdling; (2) felling and piling and burning the slash; (3) combination of (1) and (2); (4) broad-cast burning.

Of these methods girdling is undoubtedly the cheapest. A fair average cost of girdling is about 3 cents to 5 cents a tree which means anywhere from 50 cents to \$5 an acre. The most effective method of girdling is to chop a notch around the tree, cutting through the bark and well into or through the sapwood. A tree thus girdled will die in about two or three years. Girdling was practiced quite extensively for several years on sales in the Couer d'Alene Forest. The results, from a silvicultural standpoint, are satisfactory. Good reproduction of white pine has been generally secured from seed in the duff or from white pine seed trees left, and the gradual opening up of the area to sunlight through dying of the hemlock has given the white pine seedlings the necessary light for good development. The girdled hemlocks, of course, cast vast quantities of seed before they died and hemlock has reproduced prolifically, but if there are sufficient white pine seedlings to form a full stand, a mixture of hemlock will not be disadvantageous since the white pine should more than hold its own.

The objections to girdling are the unsightly appearance of the stand and the increase of the fire hazard. The first objection could be largely avoided by eliminating girdling along roads and trails. The increased fire hazard is a real disadvantage. Undoubtedly when the girdled dead trees begin to come down in the course of five or six years they will form a greatly increased fire hazard. Also the standing dead trees are dangerous agencies for scattering a forest fire by throwing sparks. The general consensus of opinion seems to be that girdling heavy stands of defective hemlock or white fir on a large scale cannot be justified.

If we do not girdle, what then? If we cut down the defective trees, the slash must, of course, be disposed of on account of the fire menace created. This may run into prohibitive costs. There are many stands in the Kaniksu Forest which carry from 20,000 to 40,000 feet per acre gross scale of defective hemlock. A fair estimate of the cost of felling is 40 cents per thousand and for lopping, piling, and burning, \$1.25 per thousand. Disposal of a stand of 30,000 per acre would at this rate cost \$49.50 per acre, which is a pretty big investment, even assuming that we thereby get adequate natural reproduction of white pine.

In the Coeur d'Alene Forest on Lieberg Creek several areas were experimentally treated in this way. All the hemlock and white fir left after logging being felled, lopped, and the brush piled and burned. The cost in four separate areas of 3.76 acres, 4 acres, 1 acre, and 8 acres amounted to \$34.49, \$26.93, \$27.20, and \$28.30, respectively. The number of trees so treated is of record only for the first plot of 3.76 acres on which fifteen trees per acre from 10 to 22 inches and 123 trees 2 to 10 inches d. b. h. were slashed. The above costs were in addition to the cost of disposing of the slash from the merchantable timber cut which amounted to \$19.41 per acre for the first plot, not recorded for the second and fourth plots, and \$28.56 for the third, the cost per thousand being about 60 cents.

In order to attempt a reduction in this excessive cost of about \$30 per acre for disposing of the hemlock and white fir left on the area, another area of 6.8 acres was treated by the method of girdling all trees above 10 or 12 inches and slashing, piling, and burning the smaller trees. Twenty-eight trees per acre from 10 to 36 inches were girdled, the weighted average diameter of the girdled trees being 18.2 inches. No record was kept of the number of slashed trees. The total cost of falling and piling slash from the hemlock and white fir and girdling 28 trees amounted to \$14.64 per acre. Of this amount \$13.24 went for slashing and \$1.40 for girdling. In addition \$10.89 per acre was expended for piling and burning slash from a stand of 18,000 feet per acre of merchantable timber which was cut.

This cost of \$14.64 per acre for a combination of girdling with felling, piling and burning, represents a considerable reduction over the cost of about \$30 on the preceding plots for complete felling, piling, and burning, particularly since there was apparently a considerably larger volume of hemlock and white fir to be disposed of than on the other plots. I believe that this is going to prove the most practicable means

of disposing of defective hemlock. There is a question, of course, as to how much girdling should be done. If all the small low crowned trees are felled and the brush disposed of, the fire hazard from the larger trees to be girdled would be considerably less than if the small trees were girdled. The fire hazard from the large trees will not be material until the trees commence to fall, which would not ordinarily be in less than 6 or 7 years. By that time all the needles would have fallen off and the fire hazard will be made chiefly by the branches and trunks of the fallen trees. The trunks cannot be gotten rid of by any method. I should say that the fire hazard of an area with from 10 to 25 girdled trees per acre would be considerably less than in a similar area burned by a forest fire or by an intentional broadcast burn. On the girdled area the forest floor conditions are not disturbed. There is still the growth of ferns and perennials which occur in the white pine type rather than the grass, fire weed and thistles which form one of the greatest fire hazards of a broadcast burned area.

A fourth method of hemlock disposal is to fell all material remaining after logging and broadcast burn. It is necessary to fell the unmerchantable trees since a broadcast burn which would merely scorch and kill standing trees would leave a fire hazard almost as great as the original logging slash. This method was tried experimentally on an area of 5 acres in the Coeur d'Alene Forest on Lieberg Creek and on 18 acres in the Kaniksu. On the Coeur d'Alene area, which was located on a rather steep northeast slope, all trees were felled and the branches lopped. It was found rather difficult and dangerous to burn this area on the steep slope and only three acres of the five were burned. The cost of felling and lopping per acre was \$20.76 and burning \$3, a total of \$23.76. This, of course, saved the cost of disposing of the slash from the merchantable cut which would have been perhaps \$12 per acre.

The Kaniksu area on Kalispell Creek is on a flat where the hemlock problem is perhaps at its worst. After the white pine was cut there was almost a complete canopy of defective hemlock, cedar, and white fir remaining which would absolutely preclude any probability of white pine reproduction.

On an experimental area of 18 acres all trees left after logging were felled except the big larch which amounted to perhaps two or three trees per acre. The limbs from the felled trees were all lopped so that they lay flat on the ground. Brush was cleared around the larch trees

and a fire line put around the entire area. The area was successfully burned in the fall with little or no damage to the larch and without the fire getting away at all.

The trees slashed in the area, most of which were hemlock, amounted to 174 per acre, 2 to 8 inches d. b. h., and 83 from 10 inches up. The cost per acre for the different operations was as follows:

Clearing fire line.....	\$7.15
Piling slash away from reserved trees.....	5.51
Falling and lopping.....	26.70
Filer	4.12
Foreman	3.80
Oil .....	.25
Burning and subsequent patrol.....	4.07
Total	<u>\$51.60</u>

Lumberman Drake of the Kaniksu Forest is of the opinion that it is unnecessary to lop the brush to get a good burn, and that the cost of fire line, protection of the larch and burning could be considerably reduced. He estimates the cost per acre of the necessary operations on an area of this sort as follows:

Falling	\$16.00
Fire line	2.50
Burning	1.50
Total	<u>\$20.00</u>

Since the broadcast burn saves a cost of about \$1 per thousand for piling and burning the slash from the merchantable timber, which ran in this case about 10,000 per acre, the actual cost of the stand improvement measures, based on this estimate, would be reduced to \$10 per acre.

There is some question whether white pine reproduction from seed in the duff can be expected after a burn of this sort. Larch reproduction can certainly be expected, considering the number of seed trees left, and I believe there is a probability of considerable white pine reproduction. Even if necessary to plant at a cost of \$10 per acre, this method of disposing of the defective hemlock in a stand of this sort would be far cheaper than felling all the hemlock and piling the brush. I believe this will prove the most satisfactory solution for heavy stands of defective hemlock on flats where fire can be controlled easily. On steep slopes a broadcast burn is always a dangerous proposition.

The hemlock and white fir problem is still far from final solution. It will require a good deal of experiment and administrative experience before we can say what is the best thing to do with stands containing

large quantities of these species. It has, however, been necessary to make a decision as to what should be done in current practice, and after extended conferences and discussion the following policy has, for the time being, been adopted for District 1.

1. In all new contracts in the white pine type sufficient funds must be provided through the cooperative fund or by contract requirements, to properly dispose of defective hemlock and white fir in such a way as to leave the entire sale area cut over in productive condition, and to permit the reproduction and development of at least a good percentage of white pine.

2. Until hemlock and white fir will show on appraisal at least 50 cents per thousand stumpage, chances containing very large percentages of hemlock and white fir, whether defective or sound, will not be sold, and on sales which are made, areas containing a large per cent of sound hemlock and white fir will be excluded from the boundaries so far as possible, even by leaving interior areas within the general sale boundary intact. Areas containing a large per cent of defective hemlock and white fir, and little sound material will not be as rigidly excluded as those areas containing sound material, since defective hemlock and white fir will probably never have any value. The general idea in this paragraph is to pass the problem on to the future, with the expectation that increases in hemlock and white fir values will partly solve the problem.

3. To secure satisfactory white pine reproduction and subsequent development, the degree of shade must be reduced to the equivalent of a maximum of 10 trees per acre 12 inches and over on north slopes, and 20 trees on south slopes. This includes hemlock, white fir and Douglas fir, but not larch, which casts only a light shade, or any white pine trees which may be left.

4. In the white pine type utilization of hemlock and white fir which is 50 per cent or more sound will be required down to 12 inches d. b. h., and due allowance made in the appraisal. This will be specified in the contract and strictly enforced. An exception may be made in the case of stands classified as A2 under the white pine marking rules in which only a partial cutting is to be made, and reproduction of the stand is not attempted. In this case, thrifty sound hemlock and white fir up to 14 to 16 inches in diameter may be left.

5. In general, three methods of disposing of defective hemlock and white fir may be adopted.

(a.) A combination of girdling with falling and piling and burning brush.

This will ordinarily mean felling all the small low-crowned trees up to a diameter of about 10 to 14 inches and girdling the balance provided that in order to prevent creating too great fire hazard not more than 12 trees per acre will be girdled. If there are more large trees than that which must be disposed of, they will be felled and the brush piled and burned. This operation will ordinarily require careful marking and designation of those trees to be felled and those to be girdled.

(b.) Falling and piling and burning brush.

This is a considerably more expensive operation than the previous method and will be used only when the fire hazard is such that girdling seems too great a risk.

(c.) Clean cutting and broadcast burning.

This plan involves felling all trees left after the merchantable timber has been removed except large larch which may stand through a slash fire. Burning must be done the first fall or spring after logging. This method is more or less in the experimental stage and should not be used over too large areas. It seems adapted to flats where fire can be readily controlled and when the amount of hemlock involved is very large. It is not yet determined whether it will have to be followed in all cases by planting or whether natural reseeding may be expected from unburned seed in the duff.

6. Sound and thrifty young hemlock and white fir trees below merchantable size, and patches of thrifty white fir and hemlock reproduction which have not been badly suppressed, will not be destroyed. This would not preclude cutting hemlock and white fir saplings which could be removed at small expense and the removal of which would distinctly improve the chances of white pine reproduction.

7. Along streams and roads and flats along main creeks no girdling will be done, and white fir and hemlock will either be left green or disposed of by falling and piling.

8. No maximum cost limit will be placed on measures to eliminate defective hemlock and white fir. When a sale is made sufficient funds will be provided for in the contract to accomplish the necessary measures.

9. On existing sales which do not provide adequate funds to fully carry out this policy, it will be left with the supervisor to decide what can best be done with available funds. No restriction on the number of

trees girdled will be made when the sale originally contemplated girdling, but the supervisor will decide how far he is willing to go in increasing the fire hazard through girdling.

There is room for considerable speculation as to financial and economic limitation in expenditure of money for improvement of productive conditions by disposing of defective hemlock and white fir. From a fiscal or legal standpoint there is nothing to prevent the Forest Service from investing the entire stumpage value of the white pine on a sale in disposing of the hemlock. The usual procedure in District 1 in handling both slash disposal and silvicultural measures on a timber sale is to require the operator to deposit a specified amount per thousand in the cooperative work fund, and the work is undertaken by the Forest Service directly. To take an extreme case: If an area carried 5,000 white pine per acre valued at \$4 per thousand, disregarding the hemlock, the white pine could be given away under administrative use permit, and the operator required to deposit \$4 per thousand in the cooperative fund which would amount to \$20 per acre, all to be used for hemlock disposal. There are a good many square miles in the Idaho Forests which are approaching the climax type, and the white pine has largely been supplanted by hemlock, where the value of the white pine would not suffice to dispose of the defective hemlock now occupying the ground and which must be disposed of before the land can be made productive.

I would not hesitate to sacrifice all stumpage receipts from such an area in order to put it into productive condition, if I were sure the operation were financially justifiable and that it could not in subsequent years be undertaken under more advantageous terms. There is a chance, however, that the hemlock will have some future value. Even in the very old stands there is some sound material, probably more than we are apt to think from the general appearance of the stand, and the demand for pulp material 20 or 30 years from now may be such that the value of the sound hemlock will take care of the disposition of the defective trees. Consequently, it is well to proceed a little slowly in such stands. It is true the white pine is depreciating in quantity, but quantity losses will be made up by value increases, and after all 20 years is a short time in the life of a 400 or 500 year old stand.

When it comes down to an absolute decision as to how much per acre one is justified in spending to dispose of defective hemlock and put an area in productive condition, one opens the whole field of com-

pound interest calculation and forest finance. It is reasonable to assume that average good sites in the white pine type, if well stocked, will yield 40,000 per acre in 100 years of which 50 to 75 per cent should be white pine. My guess as to what timber will be worth 100 years from now is as good as anybody's. If all species will average \$10 per thousand the stand at maturity will yield \$400 per acre. On an area such as the Kalispell Creek sale on the Kaniksu Forest, the canopy of hemlock is so dense that if it is not removed the area will remain permanently non-productive. If it is cleaned up, it will produce \$400 100 years from now. If we figure it out on a compound interest basis using 3 per cent and assuming a protection cost of 10 cents per acre per annum, which is the present average for north Idaho Forests, a yield of \$400 100 years from now will justify an expenditure of \$18 at the present time. A good many acres are now in such condition that they cannot be cleaned up for less than \$25 or \$30 per acre. Would it be better to salvage the immature white pine and leave such acreas unproductive? I should say no without qualification. Where the situation is too bad the stands should be left untouched, and the problem passed on to the future, but when the merchantable timber is cut from such stands that is certainly the most auspicious time to do what silvicultural measures are necessary. The Government is not going to leave that land unproductive forever, and even though we can now see only a 1 or 2 per cent compound interest return in the investment the time to do the work is when the merchantable timber is cut.

NOTES ON QUEBRACHO COLORADO¹

BY WILLIAM D. DURLAND

Quebracho colorado (*Quebrachia lorentzii* Griseb.) is a much faster growing tree than is generally believed. Well informed and reliable woodsmen who have been associated with the exploitation of quebracho forests in the Argentine Republic since the industry first began state that quebrachi will reproduce within a period of 40 years and attain a size such that it can be economically utilized in the manufacture of extract.

Heretofore it has been thought that 100 years at least would be required to develop a quebracho tree to an adaptable size. Hence it has been a definite policy among land owners and operators to dispose of their holdings as soon as the wood was cut or to devote their land to the pursuit of some form of agriculture. The present tendency is to retard this practice for the reason that they now believe that the production of quebracho wood as a forest crop is both possible and practical.

Quebracho is of great commercial importance and value to the Argentine republic where it is found and exploited on a large scale. The world demand for the extract manufactured from this wood exceeds that for most other tannin materials. Both the wood and extract rank first among the exports of the republic as well as among the first in importance of domestic industries. Although at the present rate of consumption, there appears to be no immediate danger of the quebracho forests becoming extinct, yet the source of supply is by no means inexhaustible. Hence any information that will aid in solving the problem of extending the life and utility of the quebracho forests of the Argentine Republic in face of their exploitation is worthy of consideration.

Table 1 indicates what can be expected of a quebracho tree growing under average conditions during the first 20 years of its life. The growth is slow and for the most part confined to developing sapwood. A 6-inch tree (d. b. h.), which is approximately the size attained in the first 20-year period of growth, produces two inches of heart-

¹ This article is based on information obtained during the writer's connection with the quebracho industry in the Argentine Republic.

TABLE 1.—*The Rate of Growth of Six Quebracho Colorado (*Quebrachia lorentzii* Griseb.) Trees During the First 20 Years of Their Life.*

Tree No.	Measurements taken in the year 1922			
	D. b. h. o. b.	Total heights		
	C. m.	Inches	Meters	Feet
1	14.2	5.7	6.5	21.5
2	14.5	5.8	6.5	21.5
3		Died 1917		
4	13.2	5.3	7.0	23.1
5	14.0	5.6	8.0	26.4
6	17.4	7.0	8.5	28.1
7	8.5	3.4	5.5	18.2

Seedlings were 3 years of age at the time of planting. Year of planting, 1905.

Data secured and compiled by W. D. Durland from the results of an experiment being conducted at Santa Felicia, Province of Santa Fe., A. R., for the La Forestal Ltda.

wood (d. b. h.) in this time. Providing a tree at this age contains 5 feet of merchantable length of heartwood, which represents conservative height growth, the production of heartwood is 4 kilos. Whereas a desirable heartwood log for extract purposes should weigh in the neighborhood of 200 kilos and the smallest marketable post, an "estacon" requires a minimum diameter of $2\frac{1}{2}$ inches, it can be readily understood that a quebracho tree during the first 20 years of its life has very little heartwood if any value. This is a fact well known and accepted by woodsmen who have observed the growth and progress of quebracho reproduction in cut-over forests. It is believed that the growth of quebracho heartwood following the first 15 or 20 years of the life of the tree is very rapid, while the sapwood remains at about the same thickness. It is stated by men of prominence in the quebracho industry that a quebracho colorado tree produces two hundred kilos of heartwood at 40 years of age. A tree that will produce this amount requires at the time of cutting a merchantable length of from 15 to 25 feet with diameters of from 10 to 12 inches, respectively. If this is correct, quebracho colorado has about the same rapidity of growth as many of the fast growing species of the north temperate zone.

The following facts concern a quebracho forest in the Province of Santa Fe of 10 square leagues in area. In the year 1890 the forest was heavily exploited. It is recorded that everything was removed down to the smallest of the post class following which the forest was abandoned as being of no further use. Within the past year (1922)

operations have been renewed on this area and quebracho heartwood logs 200 kilos in weight and over are being cut. The conclusion is self evident. The quebracho reproduction existing at the time the forest was abandoned has within a period of 30 years developed into a productive forest. Additional examples are cited by woodsmen who have witnessed numerous other similar occurrences.

In view of this information and the readiness and effectiveness with which it is confirmed, by those who have witnessed the development of such forests, we must at least accept its veracity until such times as direct investigations prove it to be otherwise. This represents the present attitude of owners and operators of quebracho forests who are sufficiently satisfied with the possibilties of its rapid growth that the idea of securing a continual yield of quebracho wood from their forest lands is being given more than passing consideration.

Similar to the forest vegetation of the torrid zone quebracho colorado has no visibly defined annual rings of growth. The age of any quebracho tree is highly problematical and unless a tree's age can be calculated from historical references it remains unknown. Hence the interest that is being shown toward information which can easily be described as unscientific, is in part justified.

Concerning quebracho colorado very little specific data is available. For this reason the attached volume tables (Tables 2 and 3) are included with this article.

Quebracho extract wood and firewood are sold by weight. While quebracho wood in any form or weight can be utilized in the manufacture of extract the 200 kilo log is the most economical. In general this corresponds to anything over a 12 or 14 inch tree.

Quebracho firewood of the best quality is known as campana wood. It constitutes the heartwood which remains from the complete decay of the sapwood and bark following the tree's death. The process takes about 5 years. Campana wood is undesirable for extract purposes as the brittleness of the wood hinders the operation of the chippers in the factory. Pieces less than 2 inches in diameter and greater than 10 inches in diameter are unsuitable for firewood. Lengths vary but in general are 30 inches. Quebracho is used in the Argentine Republic for almost every purpose to which wood can be put but the foregoing with perhaps the inclusion of railway ties, embraces the most important uses.

One hundred and twenty-five different tree species are found in the Argentine Chaco. Because of the scarcity of wood each of these

species finds some use in the daily life of its people. Although attempts have been and are being made to place on the domestic market, lumber manufactured from the best of these species, imported pine and fir will for some years to come be in preferable demand.

TABLE 2.—*Volume Table by Weight of Heartwood of Trees of Quebracho Colorado (*Quebrachia lorentzii* Griseb.).*

Diameter at center of piece, inches	Lengths in feet						
	5	10	15	20	25	30	35
	Weight in kilos						
8	21	45	67	87	109	133	154
10	39	77	115	157	196	235	373
12	63	129	193	255	322	385	448
14	95	193	287	381	476	574	669
16	133	266	399	532	665	798	931
18	193	353	529	707	882	1,061	1,231
20	247	451	679	907	1,131	1,358	1,586
22	283	563	847	1,131	1,411	1,694	1,978
24	353	703	1,057	1,407	1,761	2,111	2,464
26	420	843	1,263	1,683	2,103	2,523	2,947
28	504	1,011	1,515	2,019	2,523	3,027	2,535
30	585	1,166	1,750	2,335	2,929	3,500	4,085
32	686	1,372	2,055	2,741	3,427	4,113	4,799
34	795	1,582	2,377	3,167	3,959	4,749	5,541
36	893	1,789	2,681	3,577	4,470	5,362	6,258

Specific gravity used, 1.2.

Bark and sapwood thickness deducted. Data secured by plotting measurements of 57 trees.

Data secured and compiled by W. D. Durland in the Province of Santa Fe, A. R.

TABLE 3.—*Volume Table by Weight of Quebracho Colorado Campana Wood (*Quebrachia lorentzii* Griseb.).*

Diameter at center of piece, inches	Lengths in feet						
	5	10	15	20	25	30	35
	Weight in kilos						
2	4	8	12	.....	.....	.....	.....
4	15	30	46	60	.....	.....	.....
6	34	64	102	147	172	.....	.....
8	60	133	182	248	305	368	.....
10	95	193	287	382	476	574	669

Computations based on a specific gravity of 1.3.

Data secured and compiled by W. D. Durland in the Province of Santa Fe, A. R.

THE SUPPLY OF RAW MATERIAL FOR THE PAPER MANUFACTURE OF FRANCE

By L. VIDAL¹

TRANSLATED BY THÉODORE S. WOOLSEY, JR.

Is the consumption of paper today restricted to some 400,000 tons (now reduced to two-fifths pre-war rate) to become again as formidable as before the war? If it resumes its former dimensions, can we supply the demand, have we the indispensable materials to do so?

More than ever, at the moment when it recoils at sight of the economic battles which will succeed those of the front, our industry needs to clear up the question and to provide for all eventualities.

The National Bureau being consulted has presented to the Minister of Commerce a report "On the needs of the French Paper Industry in raw materials for the five years which will follow the signing of the peace" (October 10, 1918). Relying chiefly on this report, made by the authorities most qualified to speak, we shall examine this important and complex question.

BEFORE THE WAR

The ordinary raw product for our paper machines before the war is well known. For a long time rags have played quite a subordinate role in their supply: about 5 per cent. The essential base was wood in all its forms. Chemical or cellulose wood-pulps formed the principal ingredient; ground-pulps, a coarser product was incorporated with all ordinary papers, to bring down the price; chemical straw and alfa grass furnished a small addition to the wood-pulp; simply "broyée" with lime (straw) gave the ordinary flexibility; cordage and jute and phormium packing-cloth yielded an appreciable quantity of fibre, brown but tough; there was also old paper.

Textile fibers, at least the best of them, like cotton, linen, hemp, and "ramie" give a paper-pulp formed of *normal cellulose*; by that is meant a pulp not only pure but natural and which, for that reason,

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is very pliant, very elastic and very tough. A second category is formed of ligno-cellulosic substances (wood and coarse textiles) which can either give a *chemical pulp*, purified, that is, by delignification, or used as they are (*ground pulp*).

Here follows, summed up in a brief table, the list of these different materials, with their yield in paper-pulp, and the uses to which they are best suited:

	Yield per cent	Nature of the paper-pulp	Uses
Cotton rags.....	80-85	Normal cellulose....	Fine paper for registry and impressions. Paper for public documents, drawing, photographs.
Linen rags.....			
Woolen rags.....	75-80	Colored demi-pulp...	"Cartons bitumés," blotting-paper, wrapping-paper.
Hemp cordage.....	75	Normal cellulose....	Cigarette papers.
Jute cordage.....	65-70	Normal cellulose....	Strong wrapping-paper.
Pack-cloth (phormium)	65-70	Normal cellulose....	Strong envelopes.
Ramie bark.....		Normal cellulose....	Bank notes.
Paper mulberry bark.....		Normal cellulose....	Papers for the far East.
Caj-Djo bark.....		Chemical cellulose...	Japan paper.
Fir.....	85-90	Ground pulp.....	Common paper and card-board.
Fir.....	75	Brown pulp.....	Tough card-board, leather-board.
Fir.....	35-40	Chemical cellulose...	Fine, medium, and common papers.
Aspen.....	85-90	Ground pulp.....	Medium and ordinary paper.
Aspen.....	35	Chemical cellulose...	Fine and ordinary impression-papers.
Straw (rye, wheat, oats)	35	{ Ground plup.... } { Chemical cellulose }	Wrapping paper, called butcher's paper. Fine and medium paper.
Alfa grass.....	42-45	Chemical cellulose...	Fine paper called English.
Bamboo and reeds.....	30-40	Chemical cellulose...	India and far East papers.
Old paper.....		Various mixtures....	Common paper, card-board.

But we hadn't what we needed of these raw materials, however varied and unequal.

Wood, much the most important item, was lacking. Our factories handled, either chemically or mechanically, about one million steres (about 280,000 cords). They found hardly one-half of that on the

spot. Our forest domain is of moderate extent, and paper is not the only industry to exploit it: it competes with boards, planks, etc., and with the spectre of deforestation. We imported therefore wood from the North, which so far as that goes, was preferred because of their homogeneity.

It was not 1 million, however, but three times that—3,000,000 steres (850,000 cords)—that would have been needed had we ourselves prepared all our pulp.

Instead of powerfully developing our pulp manufacture, and importing the necessary wood, we found it expedient to buy the pulp ready made.

A graphic drawn by M. A. Crolard (*Paper for Books; a report made to the Congress du Livre, 1917*) showed in a striking manner the growing importance of this traffic.

In 1913, the importation of ground pulp was 259,000 tons. In 20 years it had almost tripled. In the same year, the importation of chemical pulp was 205,000 tons, more than six times as much as it had been 20 years earlier. Therefore, for the greater part of its raw materials, the French paper industry was becoming more and more dependent upon the foreigner. It was dependent even upon Germany, and for a quite important amount. Just before the war, Germany and Austria, who were the great exporters of cellulose, sent us 65,000 tons a year. That was almost the third of our importations of chemical pulp. As for ground pulp, it is true that we were not then buying it of them. We continued to import that from the North.

That was the situation so far as wood was concerned; the other materials were not important enough to modify it. Rags were not exactly scarce since, as the National Bureau pointed out, we exported considerable quantities, but they were too dear, and because of that were more and more reserved for the finer papers. Straw and jute are only suitable for certain papers and are of limited use.

There was then but one class of raw materials whose production was really susceptible of great development. Those are the substitute-cellulose, those pulps of other material than wood. That their value was generally recognized is proved by the immediate and lively success of the book of M. Henry de Montessus de Ballore, treating of their manufacture.

Reeds, broom, gorse and similar plants have never been seriously exploited. The resources of the mother country are but moderate in

this respect. The case is different in the colonies, where the heat of the tropical climate enormously favorises vegetation, and where the stands extend further than one can see over enormous distances. But when, stopped by difficulties that did not even check our neighbors, we fail to exploit the alfa grass that is found at our very doors, how should we have brought the baobab from Senegal, the papyrus from the Tchad, rice and bamboo from Indo-China?

This is why in the years before the war, manufacturers with good reason began to be uneasy. They foresaw scarcity, the inevitable increase of prices, the growing difficulty of fighting foreign competition, keener every day.

DURING THE WAR

The war broke upon us. When, after the first excitement, it became possible after a fashion with old workmen, foreign laborers and women, to get together an emergency staff, one was seriously hampered by the poverty of raw materials.

No wood arrived from the North: that of France, requisitioned for more essential needs, was grudgingly doled out to us; cotton was required for the manufacture of powder. It was quite impossible even to dream of our colonial riches; their exploitation would have been extremely difficult, their transport an insoluble problem. We tried to fall back on our indigenous products: reeds, reed-mace, Indian grass, sorghum, couch-grass, vine-shoots, broom, gorse, giant fennel, sea-weed, pine-needles, dead leaves, pulp, oil-cake . . . what have we not tried? Of course, all these materials can make paper. Yes, but what paper, and at what prices?

Was it worth while to fit a factory with special equipment which would perhaps be limited to the duration of the war? Could one expect to get a raw product always rather costly, at this moment exorbitant. The most daring manufacturer recoiled before these formidable risks. Innovators have today reason to congratulate themselves that they were stopped by the extraordinary difficulties, for their ruin would probably have been as complete as that of our enemies.

AFTER THE WAR

Peace and security having returned, the question may be taken up again under quite other conditions. Backed by the facilities of the

better position, enjoying, in our turn that advantage which so long served our rivals, we can and we should undertake an industry that can only be profitable after a long period. The present must first be considered.

The National Paper Bureau is optimistic; it thinks it will be easy to go on. First of all its points out that it will be easy to guarantee to our pulp factories all the wood they need, since the Entente is now mistress of the chief forestry regions: Canada, Finland and Russia. Instead of the 500,000 steres that we ordinarily imported we can count on 800,000, better still, on 850,000 steres, and can let our national forest reestablish themselves.

After that, comes a very important point. The National Bureau is considering the possibility of imposing upon our enemies an annual tribute of paper-pulp. It has even indicated to the Ministry the method by which this could be done: "The allied governments might profitably consider imposing on Germany, as against the delivery of a certain annual contingent of the wood which they possess, that of a proportional contingent of pulps of chemical cellose which they would divide between them and sell to their own people. These pulps, bought from the Germans at net cost, resold in the allied countries at the price of pulp imported from friendly countries, would yield a profit to each ally, making the German cellulose factories participate in the payment of the war indemnity."

It is indeed a clever scheme, and should please the Government, since, given the vastness of the debt, it is difficult to see how it can be paid off except by payment in kind.

In that case, however, we should still be receiving, not only our wood but our pulp from abroad, quite as before the war, or on an even greater scale, as it would be a means of securing our indemnity. Would that be without ill consequences? Sir Eric Geddes, First Lord of the Admiralty, speaking at Cambridge on the 28th of last November, sounded a note of alarm. "If," he said, "we received the indemnities in merchandise, the inactivity of our own production and labour will follow. . . . We should not make a fetish of this question, since we could easily, in this fashion ruin the working classes." And there lies a whole disturbing and unforeseen side of the problem. If we are not careful, we risk falling deeper than ever into the mistakes already condemned.

We have, in truth, reached the point of being merely converters,

mixers of the pulps which we received all prepared. Now, that is the atrophy, the ruin, the death of the paper industry. M. Biclet, M. Navarre, in the conference at the Chamber of Commerce at Grenoble, which have made a tremendous impression, have pointed out the greatness and imminence of the danger in different terms, but with an equal vigour. As they truly said, if the fabrication of paper is not to perish in France, it must become again a comprehensive industry, preparing all its own pulps, learning to be self-sufficing, and to utilize resources as great as they are now disregarded.

Therefore, the annual tribute which may be imposed on the vanquished must not excuse us, or even hinder us from reorganizing our industry. On the contrary, the indemnity should be a valuable premium which will allow us to start up all our paper-factories, to resume our full activity, to carry on, without idle shops, through the transition period, during which we shall be preparing our reorganization with the objective before us of an autonomous and entirely national production.

THE PROGRAM OF TOMORROW

In March, 1917, the President of the Republic, opening the Congrès du Livre, exclaimed with his usual eloquence: "Is it not distressing to have to admit that our paper manufacture, of so ancient a renown, of so glorious a past, no longer draws from our own country the food it requires, but is bowed under a humiliating dependence upon foreign production. Is our soil no longer fit for the fir, the aspen, the birch? Does alfa no longer grow under the skies of Algeria, of Morocco and of Tunis? Have our colonies been stripped of textiles, of reeds and of bamboo?" Yes, there is depicted, in authoritative manner, the work to be undertaken without delay. Does that mean that we are to take up again the projects of exploitation of every possible or imaginable material of which there has been question, entirely at random, during these four years of war? Certainly not, the greater number would be only disappointing; we must choose among them.

TO INVENTORY AND STUDY OUR RICHES

We must first of all take an inventory of our riches. This labour has been begun, and we have only to continue it with greater method, centralizing the results obtained from many sides. In truth, almost

everywhere, simultaneously, in rather haphazard fashion, investigations have been undertaken in regard to papyriferous plants. In Paris, many laboratories have shown remarkable activity. Let us name only, there are many others, the laboratory of Phyrotechnie (created by the Comite Biologie) in the Bois de Boulogne, that of the Conservatoire des Arts et Metiers, that of the Jardin Colonial, that of the Societe Cellulose et Papiers (Andre Le Chatelier).

In these laboratories, especially in the first, thanks to the fertile impulse given by the eminent president of the Union of paper manufacturers, M. Albert Crolard, deputy for Haute-Savoie, a real prospector's work has been done, which has singularly cleared the ground.

Many inventions fail to pass this first examination. The material shows itself only slightly fibrous, difficult to handle, of ridiculously small output. It is not worth following up.

If, on the contrary, the results are favorable, the appropriate industrial treatment has then to be found. As M. Crolard says, "We have the good fortune to possess in France a real experimental factory in the School of paper-making of Grenoble." Indeed that is in truth the role of that establishment, which is not only intended to teach, but is organized for technical research. Its distinguished director, M. Barbillion, professor of the Faculte des Sciences, stated quite recently that experiments may be made there on a big scale, in actual industrial conditions, because they are made, not with demonstration machines of toy-like construction, but with the actual machines used in factories. On the sole condition of disposing of so many hundred kilograms of the necessary stuff, experiments may be multiplied, varying successively the factors, carrying out, with leisure and method the researches needed for the discovery and perfecting of a process; all things difficult to do in an ordinary factory, where it is inconvenient to interrupt the work in hand.

When these studies are finished we shall have a last disengaged the really utilizable materials from the enormous medley of inventions, most of them more or less ridiculous.

RESOURCES IN FRANCE

These materials, let us say at once, are not very numerous in France itself. At the moment, we see only three or four, of which much is rumoured, but which we prefer not to name, as their exploitation

is not yet perfected. The multiplication of the Canadian poplar, said to be of rapid growth, of which M. Crolard has made himself the indefatigable apostle, will certainly be a good thing, but is necessarily, not useful.

COLONIAL RESOURCES

For the colonies the question is infinitely more interesting. The future quite certainly lies there. Whether we limit ourselves to the wild plants, or undertake their cultivation, it is only there that we can obtain raw material in great abundance and at a low price.

Algeria, because of its proximity and facilities of all sorts, is of capital importance. Now Algeria contains two materials of the first rank; alfa and dwarf-palm.

The alfa is so abundant that, according to credible reports, the harvest could be doubled without harm. Without lessening the contingent sent to the English, we could annually manufacture, like them, 60,000 tons of alfa cellulose. That is almost the third of the cellulose that we import. The dwarf palm is easy to handle and gives an excellent fibre. Its possibilities, while not so great as those of the alfa, are certainly considerable.

In Senegal, we have the bark and the wood of the baobab. In equatorial Africa: papyrus, bamboo, dha, and perhaps hedychium. In Madagascar: ravinala, cyperus. In Indo-China: bamboo, rice, imperata, luc-binh, abacoa, caj-djo.

I grant you, these are not wood. Except the baobab, perhaps the eucalyptus and the silk-cotton tree (and none of these are resinous woods, analogous to the fir), we have no wood for paper. The cellulose of alfa, of straw, of bamboo, etc., cannot completely replace those of the fir, but they can be substituted for it in a large measure.

We shall continue, therefore, to use great quantities of the resinous woods, since their properties are precious, but it may be, by utilizing them better, in the manufacture of better paper, in whose composition will enter more cellulose and less ground wood. Spurred by competition we had reached incredible tenuities with great damage to the equality, at a time when the reader of the New York Herald was demanding that his sheet should be stiff enough not to double over when he held it spread out. Our miserable newspaper, our impression-paper, and record copy paper may all be greatly improved by the generalized use of the colonial celluloses.

PROCESSES OF MANUFACTURE

It is not only by employing new raw materials, but also by successfully modifying our processes of manufacture that we shall adapt ourselves to a situation that has been profoundly transformed.

First of all we must consider the question of manufacture on the spot. That is an absolute necessity. Paper-yielding plants cannot be transported, for they suffer great waste; with the rise in freights that is even truer than in the past. Until the war, however, treatment on the spot was considered difficult, burdensome, impracticable. The dearness of coal and of chemical products, often, too, the indifferent means of transport, paralyzed our efforts. These difficulties have not even now disappeared, but they will probably cease to be insurmountable because the rise in the price of pulp and its stabilization at a reasonable figure, which we are now in a position to fix, will give a sufficient margin of profit. The trade in colonial pulp will thus find an elasticity which it has hitherto utterly lacked.

None the less, we should be riding for a certain fall if we did not keep in mind the special conditions in those distant countries. It is quite an art to adapt oneself exactly to them.

The first thing, and of capital importance, is the machinery. In the colonies, it is of great importance to use very strong simple machinery. Repairs are to be dreaded because more difficult than in Europe; there is a lack of work-shops, of machine shops, of trained personnel. The delay of waiting for a spare piece may stop a whole operation.

To simplify the machinery we are therefore led to study new processes, in certain ways more rudimentary. Coal and chemical products, brought from Europe, are dear. Their consumption must be limited by reducing the lye-washing or doing it differently.

Inspired by these ideas we are at present trying to substitute for chemical action, at least in part, a preliminary thorough separating and returning to processes of crushing of which we had no need when chemical products were cheap and labour relatively dear.

In the Clayton-Beadle operations, intended specially for hedychium and which MM. A. Olier and Company have applied to several other plants, one goes so far as to combine lye-washing with refining by mixing the lye in the pulp-trough itself. (See the full description of this patent in the review *Le Papier*, 21st year, 11 November, 1918.)

In the process of Andre Le Chatelier (Societe cellulose et papiers) the steaming-pans are replaced by open kettles and the cooking is car-

ried on indefinitely in the same liquid, adding soda as far as it disappears, what is called continuous washing, standardized washing. These patented processes have been worked out chiefly in relation to alfa, and have been tried out on a large scale at the Ecole de Papeterie at Grenoble, under the direction and auspices of the advisory Paper Committee.

To remedy the too frequent scarcity of water, various contrivances are being tried, and, especially in England, they are studying models of drying-machines.

Generally speaking, in the colonies, especially in the tropical colonies, only the manufacture of ecru pulp is contemplated. However, in certain countries the local consumption justifies the immediate establishment of paper factories. That is the case in South Africa and even in the Belgian Congo. We know that in those countries it is considered entirely desirable to carry the manufacture as far as the actual paper, keeping always in mind that they should limit themselves to making the most ordinary grades. And it is proposed that the simplest machines be used, even to the detriment of the product. There is even talk of a return to the most archaic methods.

CONCLUSIONS

It is clear that it is an entire reorganization, a revolutionary adaptation to new conditions that is today the subject of study. We have now new raw materials, new prices of labour, of power, of chemicals, of freight, of other tariffs.

All of these call for profound changes. Let us learn how to make them, let our factories "discipline and specialize themselves," let them coordinate their efforts instead of dispersing them; to restore our national industry to the first rank, let them profit by the exceptionally favourable conditions created by the most brilliant victory France has ever won.

THE FORESTS OF CZECHOSLOVAKIA

BY CHARLES SIMAN

TRANSLATED BY J. J. KRAL

About one-third (33.16 per cent) of the total area of Czechoslovakia is covered by forests which are among the most valuable natural resources of the country. According to statistical data for 1920, the forest area totals 11,517,864 acres, of which 10,791,352 acres are wooded. With Finland, Sweden, Jugoslavia, and Austria, the Republic of Czechoslovakia ranks as one of the European countries richest in forest wealth. As about 990,000 acres of waste lands and lands of low fertility are gradually to be afforested, the aggregate area of forests in the country will soon reach 12,500,000 acres. Though the country is relatively small it possesses four times as many forests as Great Britain, about 2,000,000 acres more than Italy, and about one-half as many as France. The eastern provinces are much more thickly wooded than Bohemia and Moravia as shown in the following table giving the area of forests by provinces:

	Forest area, acres	Per cent of total area
Bohemia	3,879,452	30.16
Moravia	1,588,491	28.82
Silesia	381,341	34.91
Slovakia	4,098,560	33.84
Carpathian Russia	1,570,020	50.05
The Republic.....	11,517,864	33.16

It is interesting to note that 8,625,992 acres or 74.9 per cent of the total forest area has been exploited systematically, the forests yielding a regular and steady income, while the remaining 2,891,872 acres have heretofore been exploited in a haphazard way, without any method. In the western provinces nearly all the forests can be exploited regularly, but in Slovakia and Carpathian Russia there are 1,178,750 acres of almost inaccessible virgin forests which can not be exploited systematically. In accessible forests only a quantity not exceeding the annual increment may be cut in any one year.

The normal annual exploitation, equivalent to the annual growth, has been calculated at 15,272,959 cubic meters (539,356,000 cubic

feet). Of this total 7,871,524 cubic meters, equivalent to 2,227,641,000 feet, was construction timber, the remaining 7,401,435 cubic meters, equivalent to 261,377,600 cubic feet, being classed as cordwood. These data relate to the year 1920, one of the early postwar years which certainly was not normal. With a better exploitation of the beech forests in the eastern provinces and a systematic exploitation of areas not now so exploited it is expected to increase the annual output of construction timber to 2,632,000,000 feet. The annual consumption of timber, in thousands of board feet, is estimated as follows:

	M feet
Pulp and cellulose mills.....	283,000
Mine timbers.....	198,000
Railway ties.....	84,000
Saw mills.....	1,840,000
Other industries.....	85,000
Total domestic consumption.....	2,490,000

This would leave available for exportation a quantity of logs equivalent to 142,000,000 feet. Such exportation is confined largely to Slovakia and Carpathian Russia where the logs are transported by rail to Hungary, or along the Danube or the Theiss to the countries of the Near East. Before the war Bohemia exported logs down the Elbe to Germany, but at present most of the logs are converted into boards, and logs are exported only from the frontier forests. The production of boards is large enough to leave considerable quantities for exportation. The cordwood is partly used as fuel at home, partly exported, and the remainder converted into charcoal or subjected to dry distillation. The forests also yield various secondary products, such as bark, seeds, resin, mushrooms, litter, medicinal and other plants.

As regards the conditions of ownership it is to be noted that, contrary to the general opinion, there were hardly any Government forests in the three Bohemian countries—only 16,163 acres—as the former Austrian Government had alienated the forest holdings of the Bohemian Crown. After the downfall of the Monarchy the Czechoslovak Republic succeeded to the ownership of the forests formerly held by the reigning family and the State of Hungary, and its holdings were thus increased to 1,555,045 acres, representing 13.5 per cent of the total forest area. As most of the forests were held by entailed estates of the nobility and other large owners, provision was made by the

Land Reform Law for expropriation of the large holdings which will increase the forest domain of the State by about one-third of the total forest area. In order to improve the management and exploitation of the forests it is now sought to unite the small owners in cooperative societies. The forests are to be protected against their various enemies, the clearings reforested, and waste places converted into forests. The State promotes or subsidizes numerous nurseries for the production of good seedlings.

The people are generally well informed concerning the importance of the forests and the value of methodical exploitation. There are two high schools of forestry, at Prague and Brno, where directors and inspectors of forests are to be educated. Intermediate schools, with a four-year curriculum for the education of administrative officials, have been established at Písek, Zákupy, Hranice, and Bánová Stiavnica. In addition there are three special schools for the forest guards at Domazlice, Jennice, and Lipt. Hrádek. Three large experimental stations for sylviculture are maintained at Prague, Brno, and Bánová Stiavnica, besides numerous district stations working to place forest economy on a scientific basis. The reforms proposed are to be achieved by a judicious organization of the forestry service and an efficient administration of the State forests under proper law.

REVIEWS

Preliminary Yield Tables for Second-growth Redwood. By Donald Bruce. Bulletin 361, College of Agriculture, Agricultural Experiment Station, Berkeley, California.

The outstanding feature of this bulletin is the truly remarkable yields which it is shown are produced by second-growth redwood on all sites indigenous to the species, as compared with all other conifers. Whether measured as basal area, cubic feet, or board feet, redwood produces considerably over twice as much as the highest average production as shown by standard yield tables for white pine, western yellow pine, or Norway spruce.

Yields on site quality I reach a maximum mean annual growth of 364 cubic feet at 45 years and of 2,355 board feet at 55 years. At 25 years, 320 cubic feet and 1,320 board feet per year is produced. Site II yields at 45 years 310 cubic feet, and at 55 years 1,930 board feet. On Site III, cubic feet at 40 years is 260, while board feet at 55 years is 1,560.

The unusual character of these results makes the question of methods used, and basis of accuracy, of more than usual importance to determine whether the results are actually attainable in practice, or are abnormal. The direct method of measuring yields of even-aged stands on definite areas eliminates all but two major sources of possible error; first, are the yields as measured the true product of the area of the plots on which they stood? second, are these plots normal for the type or area within which they were taken? The first error was avoided by the precaution of running the lines of the plot boundary with the stand, or, if impracticable to do this, of including at least the crowns of the trees within the plots. A check of the effect of size of plots upon yield showed a 5 per cent larger average for plots less than 0.2 acre, the average area being 0.265 acre. This could be explained by the natural difficulties attendant on securing fully stocked areas in plots of larger size.

The second question must not be confused with that of empirical, accidental, or average stocking. If stands of full density, or complete utilization of the existing site or surface can occur throughout the range

of site qualities, such stands can be found and measured. The differences in yield due to site are automatically taken care of by site classification of plots. The technique of the methods used is fully described and leaves no doubt as to the accuracy of the basis. Foresters, and land owners interested in the production of redwood, can accept these results as authentic and unquestioned.

To guard against the error of assuming falsely that these normal or maximum yields may actually be obtained as averages, the bulletin takes up the method of applying these figures to specific tracts of land, in order that proper reduction factors may be applied first, for attainable average yields, which are 10 to 30 per cent below these figures even when grown under careful protection, and second, for yields of existing second growth which may fall still lower, even to 20 per cent of the tables.

Average height is used to indicate site and it is definitely shown that open grown trees lack 13 per cent of the height of those grown in dense stands.

Stocking is to be determined by comparing the basal area per acre on strips with that in the yield table, and predicting the yields by reducing the normal by the resulting per cents.

The original data for the 135 plots are given in the appendix, classified under number of trees, basal area, average height, and yield in cubic and board feet for each of the crown classes, dominant, co-dominant, intermediate, and suppressed.

H. H. C.

Researches on Foreign Woods: Mahogany-Cedrela (Ricerche sperimentali su legni stranieri. Mogano. Cedrela) by Elivra Piccioli. Le Stazione Sperimentali Agrarie Italiane. Organo ufficiale delle Stazione Agrarie e dei Laboratori di Chimica Agraria del Regno Moderno. Vol. LV, Fasc. 1-2-3, pages 51-79. 6 figs. (Translated by Dr. S. H. Ballou and E. Gerry, MSS. at Forest Products Laboratory, Madison, Wis.)

This article discusses the characteristic differences between the genera, *Swietenia* and *Cedrela*. It includes information on the source of the principal commercial species sold as mahogany or cedrela, the quantities imported, their technical properties, uses, and distinguishing anatomical characteristics. Figures drawn from microtome sections, in

three planes, are shown for *Swietenia mahagoni* and *Cedrela odorata*, respectively.

The following species of *Swietenia* are discussed: *S. angolensis* Welw., *S. humilis* Zucc., *S. macrophylla* King and *S. mahagoni* Jacq. The common and trade names used in different countries are cited. A very detailed discussion of the anatomical characteristics of *S. mahagoni* is given which includes vessels and ray cell dimensions, etc. A classification of mahoganies into five groups based on the character of the rays and their contents is presented. A brief historical account of the early recognition and exploitation of mahogany mentions the Europeans landing in America in 1597 from the Walter Raleigh as the first to become acquainted with it, and cites its use by Spaniards in ships, and its importation into England in 1724 by Capt. Gibbon. It states that in 1753, 520,000 cubic feet were imported from Jamaica and before the recent war about 12,000 tons a year were imported by France, 70,000 by England, and 7,000 by Germany. Mahogany was introduced into India in 1795 and is now cultivated to a considerable extent. The best grades are said to come now from the slopes of the mountains in southern Mexico, in British Honduras, and in Guatemala. Strength figures are quoted from Laslett and Sargent.

The following woods which may be sold as mahogany, but which do not come from *Swietenia mahagoni*, are discussed: *Curatella americana* L. (Dilleniaceae), *Rationia apetala* Griseb. (Sapindaceae), *Anacardium occidentale* L. (Anacardiaceae), *Simaruba amara* Aubl. (Simarubiaceae), *Tabebuia Donnell-Smithii* J. N. Rose (Bignoniaceae), *Khaya senegalensis* A. Juss, and *K. grandifolia* C. D., *Entandrophragma Candollei* Harms., *Dysoxylon muelleri* Benth., and *Soymida febrifuga* Juss. (Meliaceae), *Eucalyptus botryoides* Sm., *E. marginata* Sm., *E. pilularis* Sm., *E. resinifera* Sm., and *E. robusta* Sm. (Myrtaceae), *Juglans regia* L. (Juglandaceae), *Ptaeroxylon utile* Eckle et Zeyn. (Sapindaceae), *Boswellia* sp. (Burseraceae), *Anacardium occidentale* L. (Anacardiaceae), *Persea indica* Spreng. (Lauraceae), *Myristica* sp. (Myristicaceae), and a number of species of *Cedrela*. Methods of finishing such woods as maple, walnut, locust, poplar, chestnut, and elm to look like mahogany are given as follows: (1) oxide of titanium, potash and gall nuts, (2) infusion of Brazil wood, (3) infusion of logwood, (4) infusion of seeds of *Bixa orellana* L., (5) gommagutta or safron, (6) dilute nitric acid, followed by an alcoholic solution of the resin from the fruit of *Daemonorops*

draco Blume (dragon's blood), root of *Anchusa tinctoria* L. and aloe.

Thirty-five species of *Cedrela* and their sources are mentioned. The following more important species are discussed in detail: *C. odorata* L. and its varieties, *C. bogotensis* Triana et Planch., *C. fissilis* Vell., *C. guianensis* Juss., *C. inodora* Hassk., *C. sinensis* Juss., and *C. toona* Roxb. The article closes with a page summary of the characteristics in regard to color, odor, taste, hardness, annual rings, specific gravity, and structure of vessels, fibers, wood parenchyma, and rays which serve to distinguish *Swietenia mahagoni* and *Cedrela odorata*.

ELOISE GERRY.

A Manual of Indian Timbers. By J. S. Gamble. Sampson Low, Marston & Co., London, 1922. Pp. xxiii and 868, plates 20 (including 96 photomicrographs of wood sections), one map of India.

This is a reprint of the second edition published in London in 1902. Practically no changes have been made, but, since the edition had been exhausted for some time and since many foresters are not familiar with this work, a review at this time is appropriate.

Essentially, this volume contains descriptions of the wood of about 1,450 Indian species together with a few exotics. The wood structure is dealt with in greater detail than any other feature. The following characteristics of the wood are described: Color, odor, relative hardness, grain, whether "close," "even," "open," "rough," "cross," etc.; annual rings, whether present or absent, and distinguishing marks; relative size and arrangement of pores; relative size and spacing of medullary rays; and arrangement of soft tissue. Only structural features which are readily distinguishable with the naked eye or hand lens are described. The illustrations of cross sections measure 2 inches square and are magnified 3½ times. They are made from photographs by transmitted light or Dr. Nördlinger's "Holzquerschnitte." No key for identification has been prepared since this would be at once a difficult task and of little practical value when made for so many species. The author gives several outlines of keys and recommends that each forest officer make keys for the woods he commonly deals with.

In addition to the description of the wood, reference is made to the bark, size of tree or shrub, whether evergreen or deciduous, mode of branching, character of leaves, geographical distribution, habitat, silvi-

cultural characteristics, economic uses, weight per cubic foot seasoned, durability, and, for some woods, the modulus of rupture and modulus of elasticity. Such references are brief as a rule but occasionally considerable space is devoted to them when their importance warrants. For example four pages of fine print are devoted to the silvicultural characteristics of teak. No attempt is made, however, to give sufficient botanical descriptions of the leaves, flowers, or fruit to make possible the identification of trees in the forest.

Since the author includes numerous woody shrubs and climbers, it is obvious that descriptions of barely one-half of the 2,513 tree species recognized at the time of writing are included in the book. Furthermore, the publisher's note relative to the reprint states that an enormous amount of fresh information has accumulated and that many new species of trees have been added to the flora since 1902. Hence, the number of species dealt with is far from a complete category of Indian timber species recognized at the present time. A dozen or more references to works on the Indian flora are given but, of course, all antedate the year 1902.

The chief commercial timbers of British India and Burma are teak (*Tectona grandis*), sal (*Shorea robusta*) deodar (*Cedrus deodara*), Andaman redwood (*Pterocarpus dalbergioides*), red sanders (*Pterocarpus santalinus*), marble wood or ebony (*Diospyros kurzii*), blackwood (*Dalbergia latifolia*), sissoo (*Dalbergia sissoo*), palmyra palm (*Borassus flabellifer*), satinwood (*Chloroxylon swietenia*), blue pine (*Pinus excelsa*), long-leaved pine (*Pinus longifolia*), sandalwood (*Santalum album*), pyinkado (*Xylia dalabriiformis*), and siris or East Indian walnut (*Albizzia lebbek*).

Approximately 11,200 vernacular names are given for the species described, but the author warns against placing too much dependence on the meaning of local names of trees. The following quotation is to the point: "Any native asked for a name thinks it a point of honor to give one, and, if he does not know the correct one, has no compunction in manufacturing one for the occasion."

The author divides the forested country into eight regions exclusive of Ceylon. It is interesting to note that the West Himalaya region has among its forest flora many genera common to Europe and America. For example, there are pines, firs, junipers, spruces, oaks, maples, birches, elms, willows, poplars, and chestnuts. The region comprising Burma and the Andaman Islands is the most important commercially

because of the large exports of teak and Andaman redwood. While the text lacks completeness as to species and is not up to date as to information available on species described, it nevertheless is a valuable work, not only for the Indian forester but for the student of world resources of timber. Throughout the text, indications are that Mr. Gamble was a painstaking observer and careful writer. He undoubtedly was a thorough student of and an authority on the subject of Indian timbers.

A. K.

Monograph of the Mistletoe. By K. von Tubeuf. R. Oldenbourg, Munich and Berlin, 1923.

There is hardly a European plant, aside from those of economic value, which can be compared to mistletoe for the interest this tree parasite has commanded and held from early ages on to the present day. In folk-lore as well as in the philosophic literature of antiquity mistletoe plays a prominent role. Theophrastus, in the fourth century B. C., had a clear concept of the parasitism of mistletoe and was well aware of the peculiar mode of its dissemination. Since his time the literature on mistletoe has grown to immense proportions.

Tubeuf, the well-known son-in-law of Robert Hartig, whom he followed 20 years ago in the chair of Forest Pathology at the University of Munich, has given us the last word on the European mistletoe, *Viscum album*. His monograph, a volume of 832 pages with numerous illustrations and maps, discusses the subject exhaustively from the point of view of the historian, the botanist, the pathologist and the forester.

The close relationship which exists between the European *Viscum* and our own *Phoradendron* with its many species makes Tubeuf's work particularly valuable on this side of the ocean. Botanically the two genera are very closely related. The type of injury to the tree and of economic loss in timber is the same for both. That the loss is far from being negligible is shown for instance by reports from the Black Forest and Alsace where cull, on account of mistletoe in silver fir, often amounts to 10 to 15 and even 22 per cent. Tubeuf discusses the difficulties connected with control of the parasite. It is interesting to note that Europe is not free from the well-meaning enthusiast who, under the slogan of conservatism and preservation of wild plant life, opposes rational control measures in the forest as well as in orchards.

in spite of the fact that the broadleaf race of *Viscum album* causes very serious damage to apple trees.

Tubeuf's volume represents a fine piece of bookmaking, in keeping with the old-established reputation of the publishing firm, R. Oldenbourg. Paper and print are far superior to most of the books arriving today from the German market. Both illustrations and maps are excellent. This monumental and scholarly work with its wealth of information should be in the library of every school of forestry, plant pathology, and botany.

E. P. MEINECKE.

Forest Distribution in the Northern Rocky Mountains. By J. E. Kirkwood, Professor of Botany, State University of Montana, Bulletin No 247, Studies Series No. 2. 1922. Pp. 180; Fig. 45.

Professor Kirkwood in an attractive bulletin of 180 pages with frequent illustrations, gives a description of the forest vegetation of Montana and adjacent Idaho in its relation to topography, soil, and climate, with special emphasis on the characteristics of the important forest tree species.

In the introduction, he tells briefly of the botanical history, and early and more recent collectors in the region. He outlines the chief topographic features, the mountains, streams, and soil formations which affect forest distribution. A chapter follows on the climate, with charts and tables analyzing the records of precipitation, relative humidity, and temperature, which have been collected by the Weather Bureau at 40 stations in Montana. Although the subsequent discussion of the forests includes data from Idaho, the climatic data are limited to the one State.

The sources of the vegetation are discussed in some detail, beginning with the fossil forms recorded from the region and outlining those elements of the present forests which have migrated from the east, west or south as indicated by the present ranges of the species. The largest element in the vegetation comprising 63 woody species, has entered the region from the west.

The region is divided into fourteen sections, for each of which the tree species are enumerated and tables given to show the percentage composition of the forests and the ranges in altitude of the more important species. These data have been largely furnished by the Forest Service.

Finally, under the heading "Forest Zones and Formations," more detailed descriptions are given of the five main zones, "The foothill transition forests, the slide-rock succession, the humid transition valleys of the west slope, the mountain forests, and the summits." For each of these, the relation is indicated to Merriam's Life Zones, and the principal species are discussed individually with the author's conclusions as to the factors which account for their distribution and relative importance in the respective zones.

A list of 75 titles of literature cited is appended.

To any one who has studied the vegetation in the region, questions of detail will occur in reading the bulletin carefully. The author would undoubtedly be the first to agree that the knowledge of the forests of the region is still far from complete. The brief discussion of viability of seeds and rate of growth of seedlings, based on a comparatively limited number of tests under the prairie conditions at Missoula which are unfavorable to several of the species, shows distinctly less favorable results than have been secured with the same species on a large scale 80 miles to the west at the Savenac Nursery of the Forest Service.

It seems doubtful whether the tolerance of western white pine is an important factor in enabling it to occupy natural openings in mature stands where it must compete almost always with advance growth of the more tolerant hemlock, grand fir, and western red cedar. The positive characteristic of delayed germination of western white pine seed by which it remains buried in the surface layers of duff, thereby escaping destruction by forest fires and germinating to form important portions of the reproduction after fires, is entirely overlooked.

The distribution of lodgepole pine on extensive burns is ascribed to distribution of the seed by wind from bordering green stands, and similarity with Douglas fir in this respect, is noted. It has recently been shown, however, in the Pacific northwest that wind distribution of Douglas fir seed is not effective for more than two or three hundred feet from seed producing trees, and lodgepole pine seed is not likely to be carried to greater distances. The relationship to forest fires seems to offer a more plausible explanation of extensive young forests on large burns. In general, the importance of fire as a principal factor in the forest distribution in the western part of the region is not sufficiently emphasized.

To those who are studying the subject in the region the treatment will seem preliminary in character in view of the information already available and the progress being made along similar lines. The book, however, provides the most complete discussion of the forest distribution of the region under consideration which has appeared. It will be helpful to forest school students in studying the silvics of the region. Foresters in general will welcome the method of approach which places emphasis on the characteristics of the different tree species rather than the physical factors which underlie the development of ecological associations.

J. K.

PERIODICAL LITERATURE

SOIL, WATER, AND CLIMATE

Korstian briefly reviews the work of Kirkwood *Precipitation and Height Growth* and of Pearson on the relation between precipitation and height growth of yellow pine, and that of Brewster on weather conditions and height growth of larch seedlings. He gives graphically the results of his own measurements on yellow pine and Douglas fir secured at the Grimes Pass Weather Bureau cooperative station, compared with the precipitation for April-May, and for April-September. The April-May rainfall shows a fairly close qualitative, though not a strong quantitative correlation. Frost injury to Douglas fir in 1914 made the height growth of this species small in spite of high precipitation. Korstian analyzed the data which Kirkwood used in coming to the conclusion that height growth is conditioned by the rainfall of the preceding season, replotted it, and shows that Kirkwood's data bear out the conclusion that height growth is correlated with the April-May precipitation of the same year. It thus appears that Pearson and Kirkwood's data are in essential agreement after all, and are confirmed by Korstian's figures.

B. M.

Korstian, C. F. *Relation of Precipitation to Height Growth of Forest Tree Saplings*. Transactions Utah Acad. Sci., Vol. 2, pp. 259-266. 1921.

The ideas of Erdmann and of Sückting on the causes and remedies of "sick" soil and formation at Neubruchhausen of dry turf are discussed. Erdmann holds that the low yields of northwestern German forests are attributable to the formation of dry turf, rather than to poverty of soil, and that such turf is caused by the species of timber, not by the soil conditions. To prevent such a condition, one should grow a mixture of species, thin frequently, and secure reproduction early. Larch is best for breaking down humus, and fir and Douglas fir are also good. Next in order come birch, red oak, black cherry, white pine, alder, and last of all, beech, pine, and spruce. To cure "sick" soil, the turf may be treated by harrowing and applying lime, by mixing with

sand, by harrowing without lime, or by removing it entirely or raking into windrows. His system of management involves early and frequent thinnings, natural reproduction together with sowing of desirable species, and a two-storied stand.—Süchting holds that the nature of the soil and climate, not the tree species, is responsible for dry turf, lack of lime and moisture being the principal factors. Spruce forms turf because the forester does not thin early enough and let light and moisture reach the soil. Not the turf, but the lack of plant food in the soil causes loss of increment. He advocates the application of lime as a remedy.—Volger considers both views partly right. Some species are more likely to form dry turf than others, while at the same time the chemical composition is important. Pine forms turf on some soils, on others it does not. To obtain maximum yield and satisfactory natural reproduction, the maintenance of proper soil conditions is more important than the condition of the stand itself.

W. N. S.

Volger, K. *Studienreise nach Neubruchhausen*. Forstwiss. Centralbl. 54:121-131. 1923.

SILVICULTURE, PROTECTION, AND EXTENSION

Aspen Culture in Sweden plays a peculiar double role in Sweden, being at the same time both shunned and sought after. It is kept down as a weed on account of the suppressing effects its root sprouts have on the young growth of more important forest trees. But it is also highly esteemed on account of the fact that the match industry in Sweden, having become a world industry, makes use of this species to such an extent that neither quantity nor quality of the aspen in Sweden, has been sufficient to satisfy the demand.

As long as the Russian forests were thoughtlessly exploited and a never-ending stream of the material flowed through the ports of Sweden, but little attention was paid to the aspen woodlands by the foresters or by the lumbermen. Twenty years ago, however, there were those among the foresters who realized that the Russian supplies could not be inexhaustible, as no attention whatever was given to reforestation or care of the aspen stands in Russia. The Russian aspen material is now gone from the world markets, although not yet on account of lack of supplies, but on account of the fall of the Czar's empire.

Growing aspen on a large scale is now to be undertaken in Sweden to supply future needs of the match industry. It will undoubtedly be a long time before the Russian aspen forests can be expected to furnish the match industry in other European countries this highly important raw material, which it did formerly. Not only in Sweden will the aspen be given more attention, but also in England, and in Denmark, where a lively interest is now exhibited in the culture of aspen. The fact is that it is a tree which lends itself admirably to the highly developed technical forest culture of the Danes.

The question is now which methods will prove the best for growing the aspen. Experiments conducted by Lowenhjelm in raising aspen seedlings have established the fact that considerable obstacles are encountered in growing this species from seed because the seed seldom occurs in large quantities and is difficult to gather, also that the seed can only be kept a short time, three weeks at the most, without losing its capacity for germination.

Several other experiments in sowing aspen seeds on a large scale have been undertaken in Sweden in the last few years, but the results have been negative, almost without exception. According to von Furst, in his book, "Die Pflanzenzucht im Walde" (p. 332), it is not possible to reproduce the aspen by planting stem cuttings; it would therefore be necessary to use seedlings or rootsprouts for planting. Both these methods have their drawbacks. The seedlings are to be preferred, as they produce, even from the beginning, a better stem form and the trees are apt to be far less susceptible to rot, than those raised from root sprouts.

The reasons for the poor results from the sowing of aspen seed are several. It is not to be compared with sowing other forest tree seeds (pine, spruce, or birch seeds); it is on the other hand a special undertaking, and the greatest care is necessary for success.

The most important requisite for success in sowing is that the seed be fertile. The results of a germination test cannot be depended on, because the germination capacity of the seeds quickly deteriorates; one is, therefore, compelled to consider to some extent an unknown factor regarding this species of seed. It is known that the male and female flowers of the aspen are produced on separate trees, and that the minute seeds are disseminated by the wind. Therefore in gathering the seed-racemes one should, according to von Furst, select those female trees which are growing close to male trees, so that one may be reasonably

sure that pollination has taken place. It has been found that male and female aspen trees often grow in separate stands. The reason for this is self-evident, namely, that the separate groups of trees have sprung up from root sprouts from one or from a few trees of the same sex.

The seeds are very small and dry rapidly in the air at the same time shrinking considerably, after which they scarcely exceed $\frac{3}{4}$ mm. in length.

The seed-racemes should be immediately placed for drying in a room free from draft; preferably spread out in a shallow layer, in order that the drying may proceed as rapidly as possible. This is of great importance for several reasons, among others, to forestall destruction of the seed by certain insect larvæ, which do not attack dry or opened seed capsules.

According to Professor Tragardh, the larvæ of *Epiblema nisella* (c1) is very likely the guilty one, as Disqu'e found it subsisting on racemes of *Populus tremella*. After the racemes have opened, the seeds should be put in tin cans and closed with lids and taken to the nursery. The sowing should then take place immediately in order to insure the greatest germination percentage. According to Wiesner, the seeds of *Populus nigra* do not germinate after being kept over fifty days.

Regarding the process of germination, Lagerberg has discovered that it is similar to that of monocotyledons the seed of which grow on slimy bottoms, the *Typha* family being a good example. Such seeds develop a main root, which is very delicate and serves as an anchor in gaining contact with the soil. This characteristic then shows that the aspen seed is adapted to a surface germination and should not be pressed down nor covered with even a thin layer of soil at time of sowing. In this respect it differs fundamentally from other seeds of many kinds. Hofmann warns against covering the seeds, and recommends sowing them in rows, which should be shallow and flat surfaced in bottom. They should be two centimeters wide with a distance of 11.5 centimeters between rows, so as to facilitate weeding, without injuring the lightly rooted seedlings. Broadcast sowing is to be avoided.

The growth of the plants was surprisingly rapid, namely 36.2 centimeters on an average for the first year. No other Swedish forest tree can show such rapid growth.

According to Sylven, the wild or uncultivated seedlings attains only a height of a few centimeters during the first year. Such seedlings then are not sought for transplanting.

It is a question whether to use the one-year-old nursery stock for planting in the field or whether to transplant in the nursery for another year. If they are to be transplanted in the nursery, the distance between the transplants should be sufficient (25-30 centimeters), having in mind the subsequent branching and vigorous height growth, which occurs during the second year. According to Hofmann, the second-year transplants attain a height between 1.6 and 1.8 meters.

It is important that the development of the root system does not go deep, but should spread horizontally near the soil surface, which of course facilitates the final transplanting. Such 1-1 stock can undoubtedly be transplanted to advantage in the field after the leaves are shed, during the fall of the year and should not be kept in the nursery longer than until spring of the third year.

In conclusion, Lagerberg again points out that the most important steps in the raising of aspen plants from seed is, that immediately after the seed racemes are gathered, they should be spread out in a draft-free room to dry. The capsules then open in 24 hours and the seeds fall out. The seedwool with adhering seeds is then separated from the racemes and packed in tin cans and lids put on them. The cans are then taken to the nursery where the sowing is done immediately afterwards. It is important to keep the surface of the nursery beds permanently moist during summer and to keep out too strong sunlight.

As previously stated the interest in aspen culture is quite lively in many European countries. A great deal of this work, and undoubtedly at considerable expense, has been carried on in Sweden with more or less success.

It is thought now, however, that the critical points in this problem have been sufficiently cleared up through Lagerberg's able and exhaustive experiments and report, of which this review is a translated resumé of the main factors only.

G. W. H.

Lagerberg. *Om uppdragning av aspförplantor.* Skogsvårdsföreningens Tidskrift. May-June 1922, pp. 125-142.

An interesting piece of work on the quantity of *Rabbit Damage* damage which showshoe rabbits do to conifers in *in Conifers* the Wasatch Mountains of Utah has been reported by Baker, Korstian and Fetherolf. A table gives the height of normal, contrasted with injured, Douglas fir, white fir and alpine fir from 10 to 60 years old. At 50 years the height of these three species is respectively 14.4, 12.5, and 16.8 feet for normal trees,

but only 6.1, 7.4, and 6.0 feet when subjected to attack by rabbits. In plantations the injury to pine is generally greater than to other species. Destruction of coyotes has permitted the rabbits to increase. Poisoning is considered the most feasible method of control, and formulae are given.

B. M.

Baker, F. S., Korstian, C. F., and Fetherolf, N. J. *Snowshoe Rabbits and Conifers and the Wasatch Mountains of Utah*. Ecology, Vol. 2, No. 4, pp. 304-310. 1921.

Korstian and Fetherolf, working at the Cotton-*Control of Stem* wood Nursery in the Wasatch Mountains of Utah, *Girdle in Spruce* found that the injury from stem girdle amounted *Transplants* to over 30 per cent when the trees inclined to the north, leaving the base exposed to the sun, and was less than 4 per cent with transplants inclined to the south. Injury to trees in a vertical position was a little over 11 per cent. Records of surface soil temperature showed that it was notably hotter under trees inclined to the north than to the south, while under the vertical trees it was intermediate. Measurements showed the trees inclined to the north to be markedly inferior to those inclined to the south in every respect. The authors conclude that stem girdle is due to excessive heat, and can be eliminated or reduced to a negligible amount by inclining the trees to the south at the time of transplanting. B. M.

Korstian, C. F., and Fetherolf, N. J. *Control of Stem Girdle of Spruce Transplants Caused by Excessive Heat*. Phytopathology, Vol. 11, No. 12, pp. 485-490. 1921.

Pinus peuce, a tree not hitherto described in Euro-*Pinus Peuce* pean forestry literature, is confined exclusively to the Balkan countries where it helps form the high mountain forest of Bulgaria, Macedonia, and former Serbia and Montenegro. It sometimes attains the size of spruce, fir, and other pines. Its deep vigorous root system makes it wind firm, and in tolerance it is midway between *P. strobus* and *P. cembra*. It ranges between 1,200 and 2,500 meters elevation, where the annual rainfall is between 600 and 1,500 millimeters and growing season four months. The tree is resistant to diseases and insects, but decreasing in abundance. Efforts to grow it have had little success because of lack of knowledge of its climatic and soil requirements. The wood resembles that of *P. strobus*.

B. M.

Dimitroff, Th. *Pinus Peuce* Grish. pp. 43, Sofia, 1922. Abstract in International Review of the Science and Practice of Agriculture (Rome). New Series Vol. 1, No. 1, pp. 150-152, 1923.

MENSURATION, FINANCE, AND MANAGEMENT

On Bjorkvik's community forest located in *Community Forest Södermanland*, Sweden, is to be found the *Under Management* heaviest stand of mixed forest in that country, and perhaps in the world, if we limit ourselves to the species of trees in mixture which it contains and consider the given area.

The area is 1,875 hectares (4,631 acres) and nearly one-fourth—23 per cent—of the entire area is covered with forest over 120 years old. Although the age distribution downwards is irregular—25 per cent is taken up by young growth less than 20 years old—the figure prepares us, however, to expect a high forest capital. The average cubic volume per hectare of productive forest land amounts to 152 m^3 (61.13 cu. m. per acre) of which 67 per cent is pine, remainder is spruce 30 per cent and birch 3 per cent. Nearly 60 per cent of the cubic volume is over 100 years old timber. In this stand the forest experiment station has laid out two sample plots. On one of these there is a tract of 0.12 hectare (0.29 acres), where the saw material reaches $1,157 \text{ m}^3$ per ha. (468 cu. m. per acre).

The yearly cut on the entire forest area is 3.3 m^3 per ha. (1.74 cu. m. per acre), or 29 per cent of the material suitable for lumber. For the year 1920 the net return per ha. was 37.29 kr. (about 10 dollars).

G. W. H.

Sven Petriti. Bjorkvik's Allmanning. Skogsvardsforeningens Tidskrift, May-June, 1922. P. 202.

The stands of larch originally of Scotch *Scotch Larch in origin*, which occur in Sweden, show an *Omberg's Crown Forest* exceptionally good development with large *in Sweden* dimensions and tall, clear bodies of a very fine form. The stand, where sample plot No. 280 is located has, according to Professor Schotte's investigations, been grown from transplants, from seed of the oldest nearby larch stand, from which the seed was gathered when the trees were not over twelve years old. This culture (plantation) has now become the most magnificent larch stand in Omberg's crown forest, with boles which at the age of 75 years attain a height of 35 meters, and 40 centimeters in diameter b. h.

The area contains 300 m³ larch per hectare (121 cu. m. per acre) and 120 m³ spruce (48.5 cu. m. per acre) in the lower situations.

The total production reaches nearly 10 m³ per hectare (4.48 cu. m. per acre) per year, of which 7 m³ is larch. Sample plot No. 282 consists of 30-year-old European larch, supposedly of Tyrolean origin.

To date 116 m³ per hectare (47 cu. m. per acre) has been taken out by thinnings and the remaining stand has nevertheless a yearly increment of 17.8 m³ per hectare (7.2 per acre) which amounts to 9.4 per cent of the entire cubic volume.

G. W. H.

Sven Petrini. Omberg's kronskog. Skogsvardsforeningens Tidskrift, May-June, 1922. P. 186.

UTILIZATION, MARKET, AND TECHNOLOGY

The method of measuring heat values by the *Heating Value* and bomb calorimeter is described, and a table shows *Price of Fuelwood* heat units per kilogram and per cubic meter of air-dry wood of various species. Reduction factors are given for computing the heat values for stacked wood of several grades. The conifers generally have greater heating value per kilogram, but the greater specific gravity of the hardwoods more than compensates for the difference. With increasing age of a tree the heating value per unit weight increases, while the density of the wood decreases. Except for pine, the heating value of fungus-infected wood is practically as great as that of sound wood. The proper price to be paid for fuelwood, in comparison with that for coal, can be computed on the basis of available heat units.

W. N. S.

Fabricius, L., and Hans Fr. Gross. *Heizwert und Wärmepreis der Brennhölzer*. Forstwiss. Centralbl. 45:83-100. 1923.

POLITICS, EDUCATION, AND LEGISLATION

Mecklenburg-Schwerin adopted a forest protection law on March 10, 1923. It provides that cut-over land must be restocked within 3 years; existing denuded land suitable for forest production must be replanted; no further forest destruction is allowed; owners of less than 25 hectares of forest may manage it as they please; the owner of 25 to 100 hectares must secure the approval of the authorities if he intends to cut over more than 4 per cent of

Mecklenburg's Forest Protection Law

the area in any one year; and the owner of over 100 hectares must follow an approved working plan, under the guidance of a trained forester, unless he himself can qualify as a forester. W. N. S.

Sch. *Mecklenburgisches Waldschutzgesetz*. Deutsch. Forstzg. 38:315. 1923.

An essential part of the program of increasing German private man timber production is the increase of production from small private holdings which are not now managed for continuous production. These tracts, which include about half of all the private forests in Germany (between 3,000,000 and 4,000,000 hectares), do not yield much over one cubic meter of wood per hectare per annum, while under proper management their yield could be increased by at least 2 cubic meters, worth 15 gold marks per cubic meter. This increase can be brought about by introducing fast-growing species, particularly Douglas fir, by lengthening the rotations and producing a greater proportion of stem wood, and by coordinating management. The owners individually cannot accomplish it, consolidation of holdings is impracticable, and State ownership out of the question; hence the only practicable means is through the formation of forest cooperatives, managed under state supervision, with membership compulsory for all small owners whose forests do not admit of sustained yield management by themselves.

W. N. S.

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Forest owners who are not operating under a fixed working plan are required to notify the proper officials four weeks in advance of intended cutting. Cutting is now allowed in stands less than 60 years old in case of high forest, and 20 years for coppice or coppice with standards. The area cut over yearly may not exceed 1/60 for tracts of high forest under 50 hectares, or 1/80 for larger tracts; for coppice the limits are 1/20 and 1/30, respectively.

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NOTES

BOTANICAL ABSTRACTS

Probably many foresters in the United States are unaware of the existence of a journal known as *Botanical Abstracts*. This paper, which is sponsored by the National Research Council, contains abstracts of all current literature published throughout the world in the botanical field. One section of this paper is devoted to forestry, and covers practically all publications which deal with or have articles containing forestry matters. *Botanical Abstracts* has been in existence since 1918, and very few articles on forestry published since that time have not been covered. As an example of the volume of work and the fields covered, the 1921 and 1922 volumes had 1,206 abstracts under the forestry section, while there were probably half that many more abstracted under such headings as Ecology, Education, Pathology, etc. One hundred and sixty serial publications have been abstracted to furnish this material, in addition to numerous books, pamphlets, and circulars issued as separates. The abstracts covered articles published in English and nine foreign languages, including French, German, Spanish, Portuguese, Norwegian, Danish, Swedish, Dutch, and Chinese. There were thirty-one countries contributing articles on forestry besides those published in the United States.

Practically every forestry article in any journal, magazine, or paper of consequence published is abstracted, the great bulk of forestry periodicals being reviewed by members of the various forest experiment stations. The forestry section of *Botanical Abstracts* is now edited by W. N. Sparhawk, and the Society of American Foresters is represented on the Board of Control by E. P. Meinecke and R. Zon, the latter also being on the executive committee.

This periodical should be in the library of every forest school and every State Forester, as well as in the library of men engaged in forestry research. A single number in itself may not be of very great moment, but the cumulative references thus built up through a series of years will give an all-embracing picture of the development, the trend and progress of forestry throughout the world. Such references, too,

will prove invaluable to any one working in the many and varied fields of forestry.

Botanical Abstracts is published monthly by the Board of Control, and the present subscription is \$5 per volume. E. N. M.

BUD WORM INFESTATION IN THE NORTHWEST

Foresters will be doubtless interested to learn that the Bureau of Entomology, U. S. Department of Agriculture, has recently investigated serious defoliations by the spruce budworm (*Cacoecia (Harmologa) fumiferana* Clem.) in northern and central Idaho and in the Yellowstone National Park, in the Tower Falls and Camp Roosevelt sections, Wyo. This destructive insect, which has devastated the spruce and balsam fir forests of Quebec, Ontario, New Brunswick, and Maine, is apparently distributed through the western states, as you will see by the following records of localities:

British Columbia, several localities.

Duncans, Vancouver Island.

Pullman, Washington.

Ashland, Oreg. Host, *Pseudotsuga*.

New Meadows, Idaho. Host, *Pseudotsuga*.

Priest Lake, Idaho. Host, *Abies grandis* and *Tsuga heterophylla*.

Priest Lake, Idaho. Host, *Pinus monticola*.

Yellowstone National Park, Wyo. Tower Falls and Camp Roosevelt section. Host, *Pseudotsuga*. The epidemic in the park is apparently spreading and a great deal of damage will be done unless it is reduced by natural agencies.

Uncompahgre National Forest, Colo. Host, *Abies concolor*.

Delta, Colo. Host, white fir.

Michigan National Forest, Mich. Host, pine.

Carson National Forest, N. Mex. Host, white fir and Douglas fir.

The bureau desires at this time to call the attention of foresters and entomologists to the possibility of serious damage by this insect to the coniferous forests of the western states. A close watch should be kept for defoliations of fir, spruce, and other coniferous trees to determine as accurately as possible the present distribution of this insect. It is believed that much of the damage which has been attributed to other defoliating insects may be primarily due to the spruce budworm, although of course the other insects also are often present.

T. E. SNYDER.

SAN MATEO COUNTY SAVES REDWOOD GROVE

Officials of the Save the Redwoods League have sent a message of congratulation to the supervisors of San Mateo County, who at their last meeting voted to purchase for public use a splendid grove of redwoods, known as the McCormick Tract, on the county road 6 miles from Pescadero. This action means the preservation of the few large tracts of primeval redwoods remaining in that immediate region, which once was covered with a forest of giant trees.

The grove is 310 acres in area, and contains approximately 18 million feet of timber. It is a veritable wonderland of forest growth, and on the banks of Pescadero Creek, within this tract, are numerous camping places for the use of the traveling public. The grove was purchased for \$70,000.

The Save the Redwoods League expressed appreciation of the co-operation of Lyon & Hoag, realtors of San Francisco, who aided materially in making possible the preservation of the grove.

MOREHOUSE PARISH IN LOUISIANA ENTERS REFORESTATION CONTRACT

The police jury of Morehouse Parish at its last meeting held at Bastrop, Louisiana, on September 4th, unanimously approved of entering 58,000 acres of cut-over lands in Morehouse Parish under the reforestation contract. These lands were cut over during the past 20 years by the Crossett Land and Development Company, which is headed by the Crossett-Watzek-Kates interests, one of the largest operators in the lumber business in the South, with mills in Alabama, Arkansas, and on the West Coast. State Forester V. H. Sonderegger appeared before the police jury and gave in detail the workings of the reforestation contract and also the future returns for both the Crossett Land and Development Company and Morehouse Parish.

About a year ago the Crossett Lumber Company established a forestry department for reforesting its cut-over lands, with a technical forester in charge and five fire patrolmen protecting its lands. The Morehouse reforestation reserve is the largest now in Louisiana, being the third lumber company to take advantage of the contract in accordance with Section 11 of Act 90 of 1922, of the Louisiana legislature. The greater portion of these lands lie in the piney woods in the northern part of Morehouse Parish bordering on the Arkansas line. A portion

of these cut-over lands are in the hardwood bottoms, and the Crossett Land and Development Company is practically the first Louisiana company to include the reforestation of hardwoods.

The division of forestry of the Department of Conservation in Louisiana has now under control and supervision 145,000 acres of cut-over lands in the State of Louisiana to reforest. In addition to the 58,000 acres of the Crossett Lumber Company, the Great Southern Lumber Company has 53,000 acres, the Urania Lumber Company has 30,000 acres, and the State owns 2,000 acres and the holdings of eight small owners, approximating from 40 to 100 acres each. In addition, Tangipahoa Parish has approved and authorized the placing of 55,000 acres of cut-over lands under reforestation. The forestry division is busy examining these Tangipahoa lands and in a short time will announce the acceptance of such lands as are qualified in accordance with Act 90 of 1922.

Land owners and lumbermen in general are showing a great deal of interest in the reforestation contract and are giving much thought to the development of a new crop of second-growth timber. Many reasons are given for this attitude—the main basis is the fact that Louisiana's virgin timber supply is rapidly disappearing. This condition prevails throughout the South and the visible supply of timber in the North is practically gone. In the South, and especially in Louisiana, a better crop of timber can be grown in one-fourth the time it takes in the central, northern, and New England States. Louisiana has established laws with relation to forestry, accredited to be the foremost in the country. Also, an efficient organization has been created and developed to enforce these laws and to encourage the land owners to grow timber under a safe and sane forestry policy. It is but a question of a few years when the nation must look to the South, especially Louisiana, for part of its future supply of building material, pulpwood, naval stores and other forest products which are so essential to the industrial activity of the country.

SWEDISH COMMISSION TO INVESTIGATE GOVERNMENT OPERATION OF SAWMILLS

Notes contributed by the American Pulp and Paper Association.

On August 5, 1919, the Swedish Government appointed a commission, consisting of five experts, to investigate and submit an opinion

as to the advisability of the Swedish State building saw mills and pulp mills for the manufacture of the timber out of the forests of the State. In other words, to determine if the State could make more money from its forest holdings by manufacturing the pulp and lumber of its own timber in its own saw mills or pulp mills.

The question of increased activities by the State in the lumbering and pulp industry came up as early as in the year 1908 and the commission appointed at that time to investigate particularly the northern scarcely populated part of Sweden (Norrbotten) stated as its belief that it was not advisable to increase the activities in that section of the country, due to the difficult conditions as regards marketing of the products (cost of timber drives, short shipping season, high freights, etc.).

The commission pointed out that the private enterprises started in recent years were quite sufficient; three pulp mills having been erected in that section since 1907 and the State was now able to sell the wood to these mills.

The commission found the situation somewhat different in the central and southern part of Sweden but even here they could not recommend a standard policy inasmuch as there would likely be many instances where the erection of a saw mill would not increase the net profits derived from the forests. Permanent saw mills should only be erected in the largest crown forests where sufficient raw material was at hand, but the State should not run saw mills in places where they had to depend in part on purchased timber. Another reason why the State should not enter into the manufacture is that the personal interest would not be taken in the management of these plants as compared to private enterprises. Further that a competent manager would not be given as high remuneration in the plants owned by the State.

The commission appointed in 1919 has studied the question from all angles. It has spent two years in collecting data which would help it to arrive at a sound decision. Some of the subjects studied are:

1. Data collected by earlier commissions.
2. The extent to which the State has been manufacturing heretofore and the results.
3. State activities in foreign countries.
4. Steps taken heretofore in order to increase the value of State forests and in other ways than by manufacture.

5. Further recommendations with a view to increase profits.
6. Records of sale at auction of timber from State forests during the years 1910-1919 in Norrland and Dalarna.
7. Study of saw mills, pulp mills, and charcoal furnaces.
8. Estimated supply of materials, years 1921-1940.
9. Marketing conditions, etc.

The commission submitted its findings January 31, 1922, making the following recommendations:

That the State erect two saw mills in suitable locations, one in Norrbotten and one in Vasterbotten.

That it build a mill on the Dala River.

That the State erect similar saw mills in other sections of the country where it was shown that manufacture would increase profits.

That the State erect or build a sulphite mill and perhaps a ground-wood mill in a suitable location in Norrbotten.

That the State order further study to be made of the sulphate industry; with a view to entering this branch as soon as there are better prospects for sale of sulphate pulp.

That the State appoint competent men to take charge of the sale of manufactured and unmanufactured wood belonging to the State.

In addition to the above measures for increased activity by the State, the experts submitted the following recommendations which would effect better marketing of the products:

To give more than two years time for the buyer to cut timber after it has been bought.

To open suitable parts of the State forests for colonization.

To regulate certain rivers in Norrland and Dalarna so as to facilitate drives.

Mr. Edwin Klintin, a member of the commission, adds that the commission's findings were based on study of conditions existing during the war period and that conditions might be altogether different after the effects of the world war have passed.

JACOB ERICHSEN.

THE GERMAN WOOD MARKET BY THE END OF 1922.

Notes contributed by the American Paper and Pulp Association, January, 1923:

In order to clearly understand the cause underlying the present scarcity of wood, it is necessary to review Germany's pre-war produc-

tion of wood. According to *Die Forstwirtschaft*, the production in the year 1912 amounted to 58.6 million meters solid measure, while the total consumption in that year was 73.4 million meters solid measure. Even the fullest utilization of the forests was not sufficient to supply the demand. Germany was compelled to import large quantities from the surrounding countries.

It is impossible as yet to determine exactly how conditions have been affected during the war, but it is not reasonable to suppose that four years of war have not left marks on the industry.

It is felt that the Versailles Treaty has been the chief cause of changing conditions. The loss of forest area under the treaty is one-tenth of that owned by Germany before the war, so that Germany owns today about 12,700,000 hectars as against 14,200,000 in 1912, and taking the present area, and with conditions as they were before the war, production would now be 52 million meters solid measure as against 58.6 million in 1912. Effective production has been further lowered by the demands for wood on the reparation account.

For the year 1922-23 the demand is as follows:

For France.—200,000 telegraph poles.

For Belgium.—1,700,000 hardwood ties; 417,000 telegraph poles; 6,000 cubic meters sawed wood for construction, and 140,000 meters round timber solid measure.

For Italy.—242,000 meters sawed wood for construction, solid measure; 15,000 meters round timber solid measure; 150,000 telegraph poles; 1,000,000 oak ties.

For England.—3,700,000 cubic meters sawed wood for construction; 1,000,000 pieces pine ties; 50,000 telegraph poles.

The German government has pledged itself to deliver the following quantity of this material demanded, provided the time for delivery thereof be extended to March, 1923:

For Belgium.—810,000 hardwood ties; 210,000 pine ties. The total quantity demanded of telegraph poles and round timber.

For England.—A sample delivery of 10,000 cubic meters wood for construction and 70,000 ties.

For France and Italy.—France would get the demanded quantity of telegraph poles and Italy the demanded quantity of sawed and round timber, as well as telegraph poles.

Fifty per cent of these quantities have already been delivered. As this program for deliveries was given to the enemy early in November,

1922, it seems to indicate that these deliveries were accepted as sufficient for the year 1922.

For 1923 were demanded 6.5 million meters solid measure, while the total German capacity is estimated at 1.4 million meters solid measure. Negotiations covering these deliveries have as yet not been concluded.

Germany, which, as is well known, even in the most prosperous times before the war, was dependent upon wood-import and only exported small quantities of same, is now compelled to export wood in the most uneconomical way, to a large extent in an unmanufactured state. The result of this compulsory export is simply disastrous to German national economics. Due to the present state of mark value, wood imports can only be made by heavy sacrifices. Even countries with lower exchange than Germany demand payment in dollars. The exported quantities of round timber which are credited on the reparation account are lost to the remanufacturing industry, which, as a result of lack of raw material, is compelled to curtail production and even shut down completely in some instances.

Over against this reduced ability to produce, stands an increased wood demand, which has arisen mainly through the diminished consumption of wood during the war. Only the most necessary repair work was done on railways, machinery and telegraph poles, etc., and the increased building construction has created a sudden increase in consumption, which cannot be taken care of with the supplies which we have left. To this is added the increased demand for fire wood, created through lack of coal which again can be traced to the Versailles Treaty.

JACOB ERICHSEN.

A Department of Forestry is just being organized at the Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma. It is planned to give general forestry courses which will give the students a comprehensive idea of the technical and economic aspects of forestry, and to carry on extension work. There is no intention of developing a full technical course in forestry. The head of the department is Christian Jensen, who graduated from Biltmore in 1905, and has been attached to the College as Forester since 1914. Mr. Jensen was elected to membership in the Society in 1921.

The will of the late D. Blakeley Hoer, of Brookline, Mass., provides that after the death of various beneficiaries the principal and income from his estate shall be used for acquiring land, preferably on the watershed of the Charles River, for the cultivation of forests thereon forever. The land is to be used for the production of lumber and for bird preserves. Useful birds, especially those feeding on insects injurious to trees, are to be protected always. When the forests become a source of profit, out of the net income $5/15$ th of the net income is to go to the town of Brookline for its high school; a similar portion to the Brookline public library; $4/15$ th is to go to Brookline to plant trees and shrubs along or near the streets, and $1/15$ th to Beth Horen Lodge, A. F. and A. M., of Brookline.—From *Science*, May 11, 1923.

A newcomer in the field of periodical forestry literature is *Mexico Forestal*, published monthly by the Sociedad Forestal Mexicana of Mexico City. The Society was organized in November, 1921, under the leadership of Miguel A. Quevedo, who has been active in forestry propaganda for a number of years. The first issue of the magazine appeared in January, 1923.

The government of Victoria (Australia) has just approved of a project for developing school forests in connection with the public schools. Definite areas are to be set aside, upon which forests are to be planted by the pupils under supervision of an expert forester. Planting is to be done with pine, at the rate of two acres a year for each tract, and it is expected that the two acres reaching maturity each year will yield returns of £500 to be used for school purposes. Energetic steps are being taken to inaugurate the work. *Te Karere o Tane*, May, 1923 (New Zealand F. S. Monthly News Letter).

Dr. James R. Weir, who for the past ten years has been in charge of the field investigations of the Office of Forest Pathology, Bureau of Plant Industry, for District 1 of the United States Forest Service (Montana, Idaho, Western Washington, Western Oregon, South Dakota, Minnesota, and Michigan) with headquarters at Missoula and Spokane, has given up this position and is now directing the work of Pathological Collections in the same Bureau. This office deals

with the classification of fungi and maintaining the extensive mycological collections of the U. S. Department of Agriculture.

Dr. Weir accompanied the Bureau expedition to the headwaters of the Amazon and other South American regions, as pathologist in rubber investigations. The expedition sailed from New York in July.

Dr. H. H. York, Pathologist in the Office of Forest Pathology, Bureau of Plant Industry, U. S. D. A., has accepted the position of Forest Pathologist, Division of Forest and Lands, Conservation Commission, Albany, N. Y., beginning July 1, 1923. For the present Dr. York will continue to work upon the white pine blister rust but other forest disease work will be taken up later.

Notice has just been received that Professor Arnold Engler, Director of the Swiss Forest Experiment Station in Switzerland, died on July 15, at Zurich. Prof. Engler was known to many American foresters particularly through his study of the relation of forest cover to streamflow. The Wagon Wheel Gap experiment was modeled largely after the experiment initiated by Dr. Engler at Emmenthal, Switzerland.

Z.

Greater recognition has recently been granted to the forestry movement by the action of the Texas legislature in increasing the appropriation for the State Department of Forestry from \$20,750 to approximately \$40,000 per annum. In addition, the legislature for the first time in the history of the State, made a direct appropriation for the purchase of timberlands upon which to demonstrate the practicability of reproducing pine timber on a commercial scale.

QUESTIONS AND ANSWERS

Willis M. Baker, Associate State Forester of New Jersey, suggested that a few pages in each issue be devoted to Questions and Answers. He agreed to start it off. It is starting as an experiment. If sufficient interest develops, it will live, otherwise it will die.

A number of foresters have felt the need of a source of information of the sort that rarely appears in print, particularly on questions which can be best answered from the practical experiences of many foresters in various parts of the country. To meet this need, forestry questions of general interest will be printed on this page, and readers who can supply answers are urged to send in their replies in time to be printed in the following issue. The name, address and position of every person asking or answering questions must be given.

If this Questions and Answers section meets with the success it should, it will be of great value in bringing the practical experiences of foresters to others who need this information. The questions asked might be considered by the editor as a guide to the sort of articles most helpful to the readers of the JOURNAL. When considerable interest is aroused in any question, and a number of comprehensive and interesting replies are received, he will have the material needed for a special article on the subject.

On questions not of general interest, or where one particular best source of information is known, it would be helpful to have some member of the editorial board make a direct reply to the inquirer. The same procedure would apply to inquiries which have been answered in previous issues.

To start the ball rolling Mr. Baker is submitting the following questions:

1. Under ordinary conditions of forest planting on old, abandoned fields in the Northeastern and Middle Atlantic States, using such species as *Pinus resinosa*, *Pinus strobus*, *Pinus sylvestris*, and *Picea excelsa*, what age and size of planting stock is most satisfactory?
2. Do you know of a source of planting stock of *Pinus taeda* and *Pinus echinata* suitable and available for planting in southern New Jersey?
3. What success has been met, if any, in planting *Sequoia* in the eastern United States?

SOCIETY AFFAIRS

The meeting of the society of American Foresters will be held this year in Baltimore, Maryland, on December 27 and 28, under the auspices of the State Forest Service, F. W. Besley, State Forester.

MEMBERSHIP

The following men were elected to membership in the Society, effective May 5, 1923:

Members—

John R. Berry	Erwin H. Rengstorff
Thomas H. Crawshaw	Harris A. Reynolds
Solon J. Hyde	John P. Van Orsdel
De Forest A. Matteson	

Senior Members—Bernard E. Leete, Carl C. Perry

Associate Members—Frank B. Hutchins, Solon H. Williams, Joseph G. Lewis

The following were elected, effective May 26:

Member—Leland S. Smith. *Associate Member*—Charles R. Johnson.

The following have been dropped from membership, as provided in Article X of the Constitution:

Senior Members—

J. M. Bedford	C. W. Gould
H. R. Bristol	J. E. Keach

Members—

E. P. Ancona	S. G. Harris
R. H. Chapler	Donald White
C. J. Conover	E. N. Kavanagh
A. L. Richey	W. J. Paeth
H. G. Foran	G. I. Porter
H. E. Haefner	N. L. Wright

The following men, elected January 1, 1923, have failed to accept the election and therefore have been dropped from the rolls:

Members—

Lionel C. Anderson	Fred H. Madigan
Charles R. Atwood	Joseph G. G. Morgan
Walt L. Dutton	Justin W. Ottestad

Associate Member—John E. Weaver

J. C. Nave, elected member in November, 1922, did not accept election and has been dropped from the rolls.

C. E. Taylor (member) has resigned from the Society.

ELECTIONS TO SOCIETY, 1917-1922

The Constitution was amended to provide for the present classes of membership in June, 1917. From that date until December, 1922, ten lists of candidates were issued, containing a total of 731 names. The following summary shows the action taken by the Society as a whole on the candidates for Fellowship and by the Executive Council on the candidates for all other grades of membership:

Proposed for	Total	Elected to						Rejected or withdrawn
		M	SM	F	AM	HM	CM	
Membership (M).....	396	376	.....	.....	.....	.....	.....	20
Senior Membership (SM).....	245	45	184	.....	2	.....	.....	14
Fellowship (F).....	25	.....	.....	7	.....	.....	.....	18
Associate Membership (AM).....	56	1	.....	.....	43	.....	.....	^a 12
Honorary Membership (HM).....	6	.....	.....	.....	.....	3	.....	3
Corresponding Membership (CM).....	3	.....	.....	.....	.....	.....	3	.....
Total.....	731	422	184	7	45	3	3	67

^a Includes one who died before action was taken on his name.

It is of interest to note that of the total number of candidates, 84.5 per cent were elected to the grade for which they were proposed. Of the remainder, 6.5 per cent were elected to another grade than that for which they were proposed, and 9 per cent were rejected or withdrawn. The relatively small number of candidates elected to Fellowship and to Honorary Membership is particularly striking. S. T. D.

HAROLD HARPER LANSING

Harold Harper Lansing, of Missoula, Montana, a member of the Society since 1921, died of cancer on May 19, 1923. Lansing received his public school education in Minneapolis, Minnesota, in which city he was born October 2, 1893. He was graduated in forestry by the University of Montana in 1916. From 1916 to 1918 he was associated with the United States Forest Service, becoming an expert in forest topographic surveying, in which work he was principally engaged. In 1918 he accepted an appointment to the faculty of the Forest School of

the University of Montana, which he still held at the time of his death. Lansing published, jointly with J. H. Ramskill, in 1922, a pamphlet entitled "A Manual Embracing the Principles Governing the Survey of the Public Lands of the United States." His loss is keenly felt, not only because of his likeable personality and a good nature which never failed, even in the face of an illness of more than a year's duration, but the broadness and peculiar blending of his knowledge of forestry and engineering made him an especially valuable man in his position.

NEW ENGLAND SECTION

The New England Section held a very successful meeting at Grant Farm, Maine, under the care and hospitality of the Great Northern Paper Co., August 20-23. Some fifty members and guests were present. Rain curtailed some of the field excursions, but those present were greatly impressed with the permanence of the work being carried out by this corporation. The 150 miles of private roads, graded and ballasted like a State highway, and the great Ripogenus Dam, built to store water in Chesuncook Lake, were the most striking evidences of long-time investment in this million-acre domain. The fine natural reproduction of spruce and fir, a result of careful fire protection, was also very encouraging to the foresters. No program of papers was made for the meeting and all discussions were informal. Twenty nominations of new members were forwarded to the Society as a result of a careful canvass of New England foresters.

PENNSYLVANIA SECTION—ALLEGHENY SECTION

The summer meeting of the Pennsylvania Section was held at Mount Union, Pa., on July 27, under the auspices of the foresters of the Pennsylvania Railroad Company. A trip was also made to the Rothrock State Forest, one of the most heavily wooded of the State Forests. At Mount Union the early plantings of the Pennsylvania Railroad were inspected, and a visit was made to the tie-treating plant.

The name of the Section has been changed to Allegheny Section, and its territory enlarged to include foresters in New Jersey, Pennsylvania, Delaware, Maryland, and part of West Virginia.

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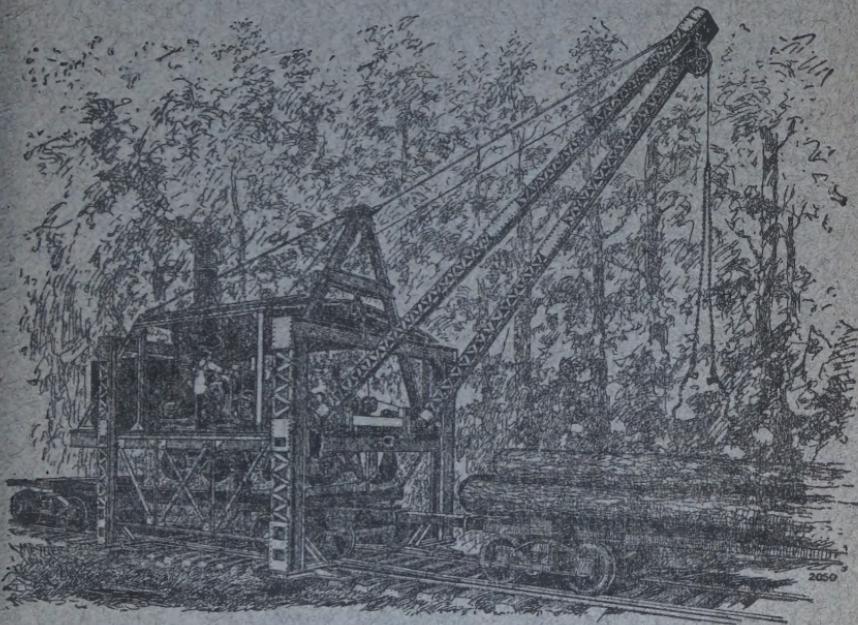
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